PROGRESSIVE MEDICINE

A QUARTERLY DIGEST

OF

ADVANCES, DISCOVERIES AND IMPROVEMENTS IN THE MEDICAL AND SURGICAL SCIENCES
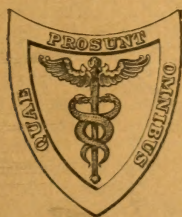
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VOLUME IV. DECEMBER, 1915

DISEASES OF THE DIGESTIVE TRACT AND ALLIED ORGANS, THE LIVER, PANCREAS, AND PERITONEUM—DISEASES OF THE KIDNEYS—GENITO-URINARY DISEASES —SURGERY OF THE EXTREMITIES, SHOCK, ANESTHESIA, INFECTIONS, FRACTURES AND DISLOCATIONS, AND TUMORS—PRACTICAL THERAPEUTIC REFERENDUM
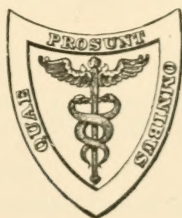
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PROGRESSIVE MEDICINE.

DECEMBER, 1915.

DISEASES OF THE DIGESTIVE TRACT AND ALLIED ORGANS, THE LIVER, PANCREAS AND PERITONEUM.

By EDWARD H. GOODMAN, M.D.

DISEASES OF THE MOUTH AND ESOPHAGUS.

Oral Sepsis and Disease. It is perhaps not within the province of the present reviewer to discuss the subject of sepsis in any form, but nevertheless, the relation of mouth conditions to general disease is so important that I feel it must receive some treatment in this place even though its consideration is not properly within the sphere of this particular department of PROGRESSIVE MEDICINE. Although it can scarcely be doubted that zeal in tracing causes and effects has led many enthusiasts into arbitrary positions concerning the part the condition of the mouth plays in disease, it is nevertheless true that the septic mouth is an important factor in the etiology of certain conditions, and the possible role it plays in the causation of disease is deserving of study of the most attentive kind. It is stated that 95 per cent. of adults have dental caries, and, although the tonsils play a part in oral sepsis, this is so infrequent that one is forced to the conclusion that in all cases of oral sepsis the seat of the trouble must be looked for in the teeth.

"It is at the junction of the gum with the dental periosteum that inflammation very often occurs. The accumulation of bacteria in this situation is facilitated by the constriction of the neck of the tooth which here provides a resting place for food and microbes; here, also, insoluble salts, in the form of tartar, are desposited. If not removed at frequent intervals, these foreign substances form a culture medium for the bacteria, which, on the one hand acts injuriously on the teeth by producing acids from the food (especially from the carbohydrates), and, on the other, attack the adjacent soft tissues at the junction of the gum with the periodontal membrane, or dental periosteum. This is

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the condition known as marginal gingivitis, and may be recognized by the presence of a red line at the edge of the gum, with swelling of the portions of gum tissue intervening between the teeth, and, in later stages, by the exudation of pus from the margin of the gums. As the inflammatory process advances, the microbial action extends deeper into the periodontal membrane, forming pockets surrounding the affected teeth, from which pus may easily be squeezed, and the walls of which are practically ulcerated surfaces. This is the condition known as pyorrhea alveolaris. These ulcers readily admit bacteria and their toxins into the adjoining tissues. It is surprising what a large extent of ulcerated surface may be furnished by pyorrhea. A simple arithmetical calculation will show that an area of two to five square inches of ulcers may be present in a mouth which is seriously diseased in this manner. The inflammation may extend more deeply, an alveolar abscess being formed, and often involves the bone, causing enlargement of the alveolus, and eventual destruction of the dental process or projecting bony ridge which forms the walls of the alveolus and intervening bony septa.

"The teeth themselves when caries has opened a pathway through the hard enamel and dentine, become a channel for the conveyance of sepsis to the tissues. In the dead pulp of a tooth many varieties of bacteria have been found. These and their toxic products easily gain admission to the body by the lymphatics and bloodvessels which pass through the aperture at the apex of the root" (McKisack).[1]

By some observers it is considered that the passage of bacteria and bacterial metabolic products directly into the stomach is the chief direction in which the evil influence of pyorrhea is exerted. During the periods of inaction of digestion, the lowered acidity of the gastric contents allows the bacteria to exercise their function in the stomach and intestines. In some cases this does not amount to much, but in others it is productive of serious consequences. The appended table shows the condition of the mouth in 155 cases collected by McKisack.

From this table it will be seen that only 9 of the cases had what might be called healthy mouths, or, in other words, we have to recognize the existence of over 90 per cent. of unhealthy mouths in the community. McKisack discusses in detail the association of diseased mouths with these various diseases noted in his table, and although he recognizes that improvement of the mouth condition is followed by an improvement of the systemic condition, this is not evidence enough to convict the mouth of being the *causa causans* of so many diseases. In the phraseology of the Scottish law courts, "The guilt of the accused is not 'proven,' but he remains under grave suspicion."

As far as treatment is concerned, McKisack has the following to say: "Caries of the teeth must not be allowed to remain unrepaired. In the earlier stages of gingival inflammation careful attention to the

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[1] British Medical Journal, 1915, i, 453.

state of the gums and the application of suitable antiseptics work wonders. Later, when deeper pockets have formed, thorough drainage of the little abscesses and ulcers and frequent cleansing of the septic surfaces may result in a cure. This is denied by some, who state, that when once a definite pocket has formed there is nothing for it but to remove the tooth. So long as there is a source of poisoning, they say, which is difficult to remove by mild measures, and which in the meantime is producing arthritis and other maladies, we must have no mercy on the tooth. This is not a sound practice. Before resorting to the sacrifice of a tooth one must make a persevering attempt by local treatment, vaccines, change of air, tonics, etc., to effect a cure.

Disease.	Number of cases.	Age.			Sex.		Condition of mouth.				Total number of teeth present.	Percentage of carious teeth.
		20 and under.	21 to 35.	Over 35.	Males.	Females.	Clean.	Fair.	Bad.	Very bad		
Chronic gastritis	19	–	6	13	5	14	–	2	7	10	247	48
Gastric and duodenal ulcer	10	3	6	1	–	10	1	6	3	–	191	21
Acute tonsillitis	3	1	1	1	1	2	–	1	–	2	52	36
Rheumatoid arthritis and chronic rheumatism	7	–	2	5	4	3	–	2	1	4	105	78
Acute rheumatism	16	8	5	3	3	13	3	3	6	4	341	23
Heart disease	25	11	8	6	12	13	2	6	12	5	509	28
Arteriosclerosis	3	–	–	3	2	1	–	–	2	1	40	37
Chlorosis and secondary anemia	8	2	1	5	1	6	–	–	5	3	130	42
Pernicious anemia	4	–	–	4	1	3	–	–	3	1	32	39
Exophthalmic goitre	3	–	1	2	–	3	–	–	2	1	20	80
Tuberculosis of lung and pleura	6	1	1	4	1	5	–	2	1	3	94	36
Chronic bronchitis	4	–	2	2	2	2	–	–	3	1	52	25
Asthma	3	–	–	3	3	–	–	1	2	–	40	25
Sundry cases	44	9	17	18	26	18	3	13	14	14	801	26

Fig. 1.—Condition of the mouth in one hundred and fifty-five cases in the medical wards of the Royal Victoria Hospital, Belfast.

"In the advanced stages of pyorrhea alveolaris, where there is not merely destruction of the dental periosteum, but when the bone is seriously diseased, there is no hope of any treatment which does not include extraction of the teeth which are involved. Scrupulous care should be given to the cleansing of all artificial teeth and other fittings of foreign bodies in the mouth."

Although the last paragraph contains a great deal of truth, I have seen, even in cases with destruction of the bone, marked improvement of the mouth condition follow careful attention on the part of the dentist, so I feel that extraction is not always to be practiced, although it is frequently to be recommended.

The importance of careful buccal asepsis should be more fully recognized by those having to do with control of hospitals, and a dentist should be one of the staff as well as the usual specialists. The prognosis of fever, and particularly cases of typhoid fever, would be more favorable could an associated unhealthy mouth receive special attention, and there is no doubt of the beneficial effects of remedying pyorrhea in cases

of chronic digestive and arthritic conditions. The teeth should receive as much attention in these cases as the disease itself, and, although gastric and joint conditions are ofttimes materially benefited by medical measures alone, our treatment would be substantially reinforced by associating with our medical care, local treatment of the mouth conditions by a competent dentist.

Pulsion Diverticulum of the Esophagus (Zenker's Diverticulum). Zenker gave much research to this form of diverticulum and emphasized the fact that the prime etiological factor was pressure from within in contrast to the traction diverticulum, which arises from causes from without the esophagus, in the nature of adhesions or scar tissue formation secondary to diseased lymph nodes. In traction diverticula, when the esophageal wall is simply pulled gradually outward by these adhesions, the wall of the diverticulum has the same anatomical structure as the esophagus. In pulsion diverticulum, on the other hand, the opposite should be the case, although very little is known concerning the origin and anatomy of the disease, owing to the variety of the lesion.

Some authors believe the condition to be congenital, while others, notably Zenker, regard it as being acquired later in life. Zenker believed that the underlying factors were mechanical. The first step is a protrusion of the mucous membrane through a gap in the musculature of the pharynx. Gradually it becomes greater, due to pressure from within, and due to the weight of the ingested food. According to this view, then, the wall of the diverticulum should be composed of mucous membrane and connective tissue, and there should be no muscle tissue present, although such is frequently found, as the increasing weight of the diverticulum causes a tearing and pulling on the healthy muscle of the esophagus. It is owing to the presence of striated muscle fibers that certain authors, while recognizing the important mechanical factors, insist that, essentially, the lesion is a congenital one.

As has been stated, Zenker's pulsion diverticulum seems to be a rare disease, although in recent years reports of cases are becoming more frequent. Maruyama[1] has made careful studies from all standpoints, the most significant feature of his work being that serial sections of his preparation failed to reveal any trace of muscle tissue, thus confirming the conclusions of Zenker. It cannot be denied that certain cases do occur in which muscle fibers are found all over the diverticulum so that there is really an ectasia of the pharyngo-esophageal border (Brun, 1904). The two most important etiologic moments are the physiologic stenosis at the junctions of the hypopharynx and the esophagus, and the age of the patient (generally between 40 and 50). When the cartilage is soft and yielding, this physiologic stenosis is well taken care of, but, when the cartilage begins to become ossified and unyielding, the physiologic stenosis behind the larynx is intensified

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[1] Mitt. a. d. Grenzgeb., 1914, xxviii, 1.

and the beginning of a diverticulum is favored. Men seem to be more affected than women; of 157 cases, 81.1 per cent. were men, and 18.8 per cent. were women. The ages at which diverticula were observed are given in the appended table:

Under 20 years	6	6.8
From 20 to 30 years	7	7.9
From 30 to 40 years	14	15.9
From 40 to 50 years	25	28.4
From 50 to 60 years	22	22.0
From 60 to 70 years	11	12.5
From 70 to 80 years	3	3.4

As a means of diagnosis, sounding is dangerous, as the wall is very thin at this point and perforation can readily occur (Veil and Zesas). The x-ray is the safest and easiest method.

Deglutition. Schreiber[1] contends that the most important factor in swallowing is gravity, and that without this factor complete deglutition is impossible. He has made some interesting observations on persons standing on their heads. A bismuth-containing fluid was given them through a rubber tube and quick exposures were made. In no case did the fluid go farther than the cervical portion of the esophagus where it remained, and in no case was the musculature able to propel it beyond this point into the stomach. He does not deny that there is a role played by muscular contraction, but he insists that gravity plays a much more important part, for he believes the musculature possesses very little real constricting or contracting force.

DISEASES OF THE STOMACH.

One of the most interesting features of the work done in gastro-intestinal conditions during the past year is that pertaining to the study of the normal. It seems to me that there has been in the past twelve months more successful attempts to put our knowledge of gastric function on a firm basis than has been apparent for a long time. It is pleasing to contemplate that a great portion of this work is of American origin, and much that has been produced will no doubt prove to be of fundamental value.

Normal Gastric Function. SOURCE OF THE HYDROCHLORIC ACID FOUND IN THE STOMACH. In view of the discrepancy between the two views held at present concerning the source of the gastric hydrochloric acid, Hammett[2] has undertaken a critical review of the subject. The two views existing at present are based on the work of Miss Fitzgerald, in 1910, which tended to show that the parietal cells of the gastric glands are the seat of the formation of the acid, and on the work of Harvey and Bensley, in 1912, to wit, that while these cells may form precursors of the acid, they do not produce the acid itself.

[1] Arch. f. Verdkr., 1915, xxi, 1.   [2] Anatomical Record, 1915, ix, 21.

Miss Fitzgerald, according to Hammett, considered that she had found direct proof of the presence of acid in the lumina of the gastric glands, in the canaliculi of the parietal cells, and even in the parietal cells themselves. By injecting a ferrocyanid and a ferric salt into the ears of animals, a deposit of Prussian blue was found in the situation above noted. No deposit was found other than in the immediate vicinity of the parietal cells.

Harvey and Bensley, who repeated her work, found, as did Miss Fitzgerald, that in some experiments the Prussian blue reaction was not obtained. Again, they believe that, when present, the reaction is restricted to limited areas, depending on the regional activity of the glands, decreased blood supply, and toxic effect of the salts injected. Another objection, which they raise, is that the reaction occurs in only a *few* cells within the areas which respond. It was found that the parietal cells of the gland tubules farthest away from the free surface never contain Prussian blue, apparently indicating that the reaction occurs only where the parietal cells are most numerous and most active. Harvey and Bensley claim to have found a precipitate in the liver, spleen, and bloodvessels of the cardiac muscle, whereas Miss Fitzgerald did not find the Prussian blue anywhere but in the tissues of the stomach wall.

According to Hammett, much of Harvey and Bensley's work supports Miss Fitzgerald's ideas, although such was *not* the conclusion of their research. For instance, they found the blue precipitate on the mucous surface of the stomach, and prove that there is no backing up of the precipitate into the lumina of the glands, but occasionally they did find Prussian blue in these lumina, therefore it must have been formed there, which necessitates acid, but the presence of which in this situation Harvey and Bensley deny.

Hammett has, in turn, repeated the work of Harvey and Bensley, using cyanamin as a section stain as did they, which dye yields distinctive colors for acid, alkaline, and neutral solutions. Harvey and Bensley, by this means, found the contents of the gland cells to be alkaline. The acid reaction occurred on the surface of the mucosa and extended as far as the bottom of the gastric pits or foveolæ. Then it changed rapidly through neutral and alkaline, and so it extended through the lumina of the glands and into the secretory canaliculi of the parietal cells.

Hammett has obtained results very similar to the above, but he explains these on mechanical grounds. "The hydrochloric acid secreted by the gland cells diffuses out of the cells, through the canaliculi and into the lumina through the free surface, faster than the dye diffuses inward along the same path. Consequently the mucous surface of the tissue and of the foveolar contents show acidity. The tissue after removal from the organ does not continue to perform its secretory

function, nor does it excrete save by diffusion. This then leaves the cell contents alkaline, as is shown by the fact that the slowly moving dye stains the cells with the alkaline reaction. Supposing we have hydrogen weakly bound to protein and ionizing in the cell to $(H)^+$ and protein. We know we have sodium ions and chlorine ions present: $NaCl = (Na)^+ + (Cl)^-$. Removing the hydrogen ions and the chlorine ions we have an excess of sodium ions, thus making the cell contents alkaline.

"The localization of the reaction between the dye and the acid is dependent upon the relative velocity of the participating constituents. Inasmuch as the acid has the higher velocity, we get the recorded results and a stable confirmation of Miss Fitzgerald's experiments and conclusions."

FRACTIONAL STUDY OF GASTRIC DIGESTION. Using the customary Ewald meal, and withdrawing the contents at intervals of fifteen minutes, Rehfuss, Bergheim, and Hawk[1] have attempted the study of
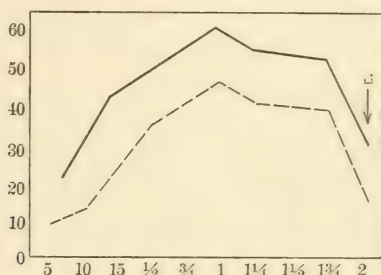
Fig. 2.—Isosecretory curves. Solid line, total acidity; broken line, free acidity. (Rehfuss, Bergheim and Hawk.)

gastric digestion in health and disease. It became evident early in their researches that there was no such thing as a specific isolated curve, but they were able to establish three broad classes of curves.

First, the *isosecretory* type shows a rise, reaching a high point of total acidity (60 c.c. $\frac{n}{10}$ NaOH) which is usually sustained for from thirty to sixty minutes, after which it gradually declines and there ensues a total disappearance of the food residues in from two to two and a half hours.

The *hypersecretory* type shows a rapid response to stimuli, often a marked change in the acidity even of samples withdrawn at five-minute intervals, there is a rapid increase of acidity reaching a high point of 70 to 100 or more, either sustained or abrupt, and a slow decline, or none at all, in the usual time. The food left the stomach in from two to two and a half hours, but for a long time thereafter there was an

[1] Journal of American Medical Association, 1914, lxiii, 909.

outpouring of pure gastric juice. They call this "continued digestive secretion."

The *hyposecretory* type is similar to the isosecretory type, but there is usually a slower ascent, a slower response to stimuli, and a high point of from 40 to 50. This seems to be the type which is least often seen.
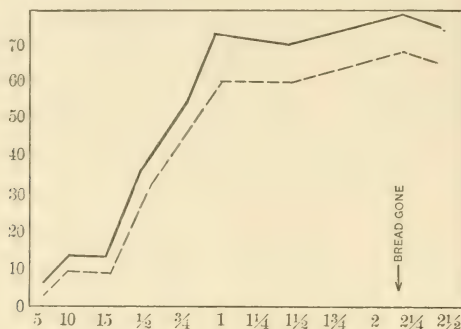
Fig. 3.—Hypersecretory curve. Solid line, total acidity; broken line, free acidity. (Rehfuss, Bergheim and Hawk.)

Since these three types are seen in normal individuals it is apparent that there is no normal curve which may be said to hold for all cases. Again, the cases of hyperacidity seemed to be in perfect health; certainly there had never been any complaint of gastro-intestinal disease, and one begins to doubt if the hyperacidity itself can be blamed for all the harmful effects attributed to it in diseased states.
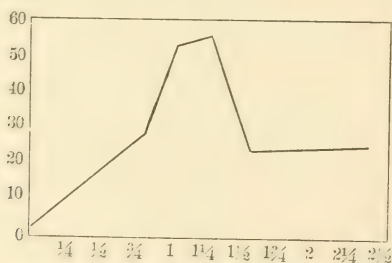
Fig. 4.—Hyposecretory type.   (Rehfuss, Bergheim and Hawk.)

Certain pathologic conditions were studied; Fig. 5 is from a case of duodenal ulcer. There was a rapid rise in half an hour, distinct and abrupt hyperacidity, rapid decline, and a rapid evacuation.

The curve in chronic gastritis is shown in Fig. 6 and the curve in cholelithiasis is seen reproduced in Fig. 7.

Fig. 8 is from a case of achylia gastrica, while in Fig. 9 may be seen the tendencies in curves.

The important feature, to my mind, in this work, is the fact that the authors have demonstrated that in health there may be a "'continued"
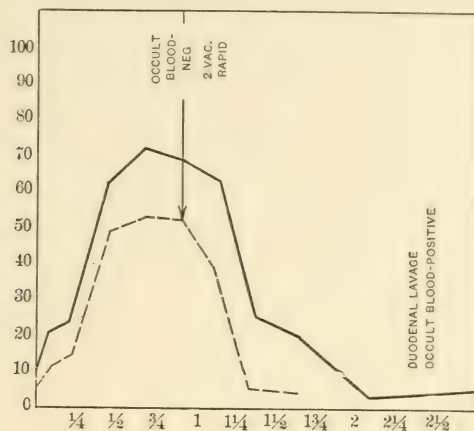
FIG. 5.—Curve in a case of duodenal ulcer. (Rehfuss, Bergheim and Hawk.)
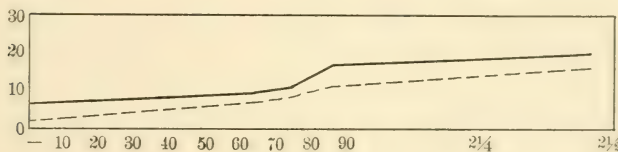
FIG. 6.—Curve in chronic gastritis marked by hypoacidity with impairment of motility. (Rehfuss, Bergheim and Hawk.)
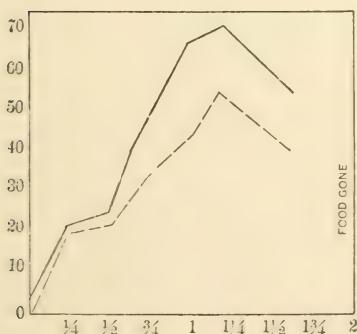
FIG. 7. — Curve in cholelithiasis. (Rehfuss, Bergheim and Hawk.)
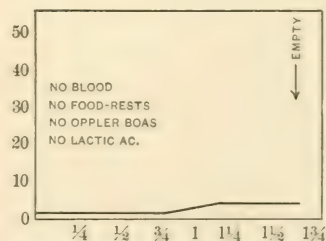
FIG. 8.—Curve in achylia gastrica. (Rehfuss, Bergheim and Hawk.)

secretion which is quite distinct from hypersecretion as it is generally understood. Also the work has a tendency to refute the usual methods

of estimating gastric digestion, as by the old method one obtains an insight into but *one* phase of a continually changing cycle; this phase is not necessarily, and is not always, the high point in the digestive curve. Just what significance is to be attached to the pathologic curves one can not say, as it will require much more work on many more cases of a certain disease to determine if one may obtain a curve typical of a certain pathologic process.

SECRETION OF GASTRIC JUICE IN MAN. The patient, the subject of Carlson's[1] researches, has had a complete cicatricial stenosis of the esophagus and gastrostomy since the age of seven. He masticates all his food in the usual way and then introduces the mass, by means of a rubber syringe, into the stomach through the gastric fistula. This man's gastric juice has been studied for three years, under all conditions, and, except for the esophageal stenosis and the gastrostomy, the patient is a normal individual.
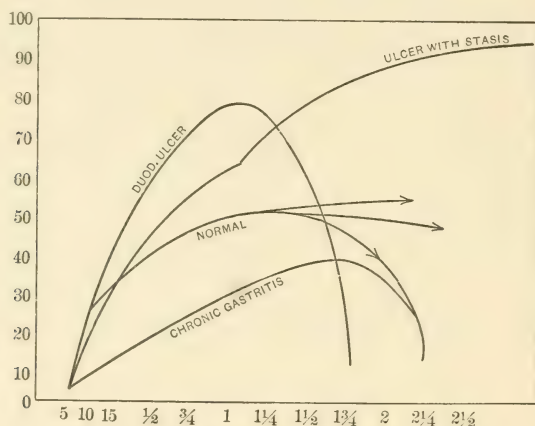
FIG. 9.—Tendencies in curves.   (Rehfuss, Bergheim and Hawk.)

It is found that the normal stomach, free of food, always contains some fluid and mucus, and is never empty. The fluid is composed of gastric juice, saliva, and duodenal contents, but the last named (bile and pancreatic juice) are frequently absent. The amount of fluid in the fasting stomach depends on the relative rate of gastric and salivary secretion, the tonus and contractions of the stomach, the rate of absorption in the stomach, and on the rate of emptying of the stomach contents into the duodenum. Normally, the general average in Carlson's case was below 25 c.c. There was more fluid in the morning before breakfast and in the summer months than in the winter months. The rate of secretion of juice is from 2 to 50 c.c. per hour, yet there may be

[1] American Journal of Physiology, 1915, xxxvii, 50.

as great a fluid content with the low as with the high secretory rate, pointing to the probable fact that gastric tonus is mainly responsible for the abundance of juice in the morning and in the summer.

There is a continuous secretion of gastric juice due to some cause or causes not entirely understood. Carlson seems to believe that the acid products of digestion, mucin, and protein of the gastric juice, may yield gastric secretagogues, and he does not favor the belief that it is an appetite secretion. As far as the effect of the appetite secretion on the secretion of gastric juice is concerned, the mere act of chewing indifferent substances and the stimulation of buccal nerve endings by substances other than foodstuffs, causes no gastric secretion. Carlson also denies the importance of visual or olfactory impressions of food, in causing the secretion of gastric juice.

Tasting and chewing palatable food is followed by an immediate response. During twenty minutes' mastication the amounts of gastric juice secreted in 156 experiments were found to be

Lowest	30 c.c.
Highest	156 c.c.
Average	70 c.c.

or a secreting rate of 3.5 c.c. of gastric juice per minute.

The secretion rate is proportional to the palatability of the food, being greater when the dessert is reached, and greatest on the days when the luncheon made a special appeal to the subject. Carlson finds also that there is no latent period in man, such as is seen in animals, but that it depends on the condition of the gastric glands. If the amount of juice continuously secreted is normal, there is no latent period at all, but if it is very low, then the appetite secretion shows a latent period of from two to four minutes.

The total secretion of gastric juice in man on an average meal averages 210 c.c in Carlson's case. He assumes that the average dinner of meat, bread, vegetables, coffee or milk and dessert would furnish the following amount of gastric juice.

First hour	200 c.c.
Second hour	150 c.c.
Third to fifth hour	350 c.c.
	———
Total gastric juice	700 c.c.

This would make in twenty-four hours 1350 to 1500 c.c. of gastric juice, or 25 c.c. per kilo of body weight.

PROTEIN CURVE OF GASTRIC DIGESTION IN HEALTH AND IN DISEASE.[1] In health the gastric juice shows a protein content of very low degree,

[1] Clarke and Rehfuss, Journal of American Medical Association, 1915, lxiv, 1737.

which content, in disease, is increased by exudation of protein from inflammatory, ulcerous, and carcinomatous mucous membranes or by the addition of partially digested or retained food particles, or by the swallowing of protein material, such as sputum.

In achylia gastrica the albumin curve runs parallel with the acid curve, whereas in carcinoma the protein curve diverges from the acid curve, and the disproportion increases as digestion progresses, so that there is a marked separtion of the curves.

In ulcer, there is a rapid rise in the protein concentration out of all proportion to the protein elaborated by the action of juice in the same period of time, which phenomenon argues for an extraneous cause of the protein.
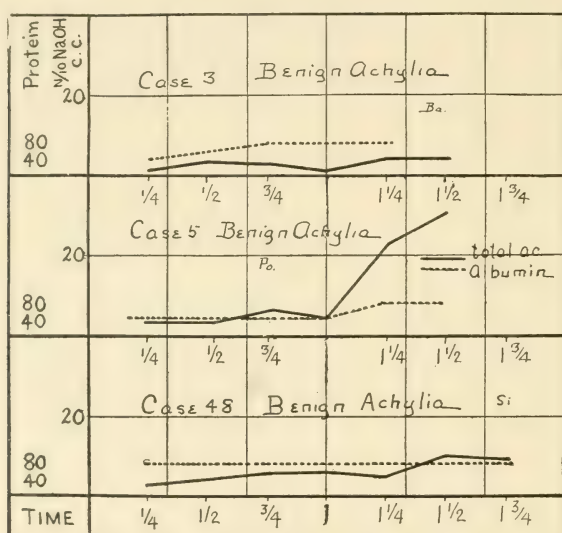
Fig. 10.—Total acidity and albumin curves in three cases of benign achylia.

We are balked in our efforts to interpret these findings of Clark and Rehfuss by the fact that they lack the weight which would be theirs were the number of cases greater. The significant feature or result of this research may be said to be the fact that if a marked increase in protein does not conform to the acid curve, the protein must come from some other source than bread. Whether to this curve of protein deviation is to be ascribed any importance in differentiating between benign and malignant processes is doubtful. The result of Clark and Rehfuss's studies is interesting to be sure, but it is doubtful if much diagnostic significance is to be attached to their observations.

EFFECT OF WATER ON GASTRIC SECRETION. It has been demonstrated experimentally by Pawlow, and others, that water has a direct

stimulatory action on the stomach. Bergheim, Rehfuss and Hawk[1] have studied this problem in man, and fail to confirm wholly the experimental work. They do demonstrate that water is a strong gastric stimulant in certain instances, an acidity of over 100 resulting in less than twenty minutes. With this increased acidity there is increased peptic activity, although the two do not necessarily run parallel. There did not seem to exist in man the latent period that Pawlow found in dogs, for high acidity values, as high as 79.5, were obtained after a minute's interval. The authors claim that a total acidity of 40 to 60
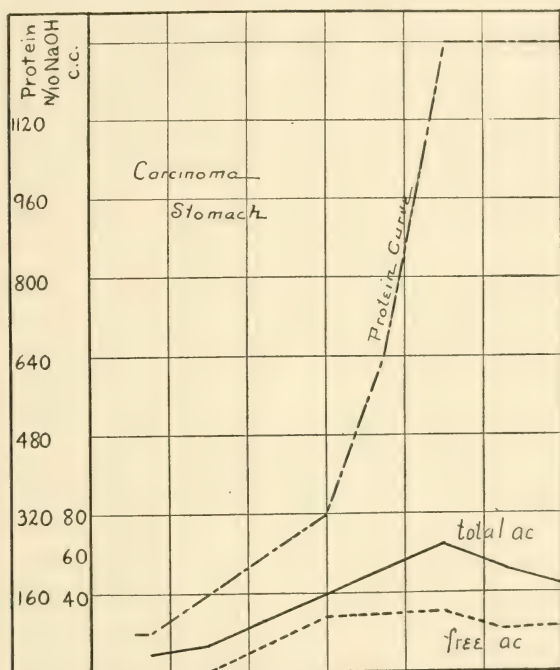
Fig. 11.—Protein, total acidity and free acid curves in case of gastric carcinoma.

is too low a normal value, the average should be 77, and the acidity in their cases ranged from 50 to 120. They suggest that water may be substituted for the Ewald meal, but, if so, then the time of removal should be before the expiration of forty-five minutes, as they found that 500 c.c. of water left the stomach in from ten to twenty minutes after its introduction.

ACTION OF BITTER TONICS ON GASTRIC SECRETION. Carlson[2] has previously demonstrated that when given in the usual therapeutic

[1] Journal of Biological Chemistry, November, 1914.

[2] Journal of Pharmacology and Experimental Therapeutics, 1914, vi, 209.

quantities, the so-called stomachics or bitter tonics inhibit gastric tonus and hunger contractions, and retard the emptying power of the stomach. In a later paper,[1] devoted to the consideration of their action on the secretion of gastric juice, he has this to say:

"The use of bitters as medicine goes back so far that there is no authentic record of its beginning, and the number of different kinds of bitters advocated from time to time as useful, is a large one. They are of so varied chemical composition that the only thing they have in common is the bitter taste." Carlson makes an exception of substances such as quinin or strychnin or the bitters with alcohol as the main constituent, as after absorption these substances have distinct physiologic actions, not referable to their appetite-producing properties.

"The bitter tonics are still 'home remedies' and 'favorite drug counter prescriptions.' They are often prescribed as a matter of
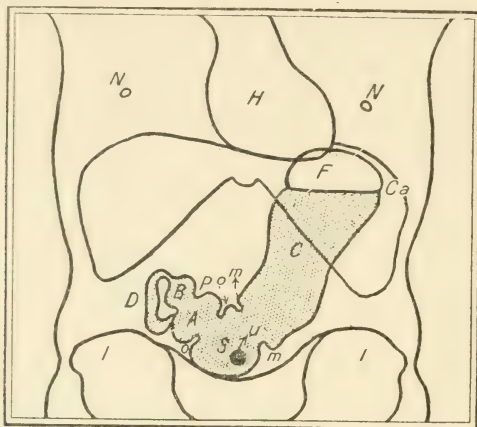
Fig. 12.—Normal stomach in erect position: *F*, fornix; *C*, corpus; *S*, sinus or vestibule; *A*, antrum; *B*, cap of duodenum; *D*, descending duodenum; *N*, nipple; *H*, heart; *I*, ilium; *U*, umbilicus; *Ca*, cardiac constriction; *mm*, angular constriction; *oo*, antral constriction; *P*, pylorus.

routine and sometimes ordered because the physician actually believes they produce good results. Is this belief well founded? These tonics are given convalescents who would continue to improve, tonic or no tonic, and the tonic, not the recuperative power of the patient, gets the credit. For many ailments the physician prescribed a more hygienic living and a tonic. The patient's health improves and both the physician and patient think the tonic did it."

Their main value, however, seems to lie as a "handmaid to psychotherapy." But if proper dietetics and hygiene do not augment appetite and hunger, the chances are that tonics will contribute nothing to bring this end about.

[1] Journal of American Medical Association, 1915, lxiv, 15.

Movements of the Normal Stomach. Walsham and Wesend[1] have summarized in a concise way our present knowledge of the mechanism of certain of the movements of the stomach in health, and part of their article is worthy of abstracting *in extenso*.

1. RADIOLOGIC DIVISIONS OF THE STOMACH. In the erect position the stomach is U-shaped, consisting of a vertical portion, two-thirds of the whole, and of a horizontal component, divided by an angular notch (incisura augularis) on the lesser curvature. The vertical portion is divided into (*a*) the (fundus) lying above the esophageal opening, and containing air, and (*b*) the corpus, which is vertical in the erect but oblique in the recumbent position.

The horizontal part is subdivisible into (*c*) the sinus and vestibule, (*d*) the antrum, and (*e*) the pylorus.

2. INNERVATION OF THE STOMACH. The musculature manifests two chief properties (*a*) tone, (*b*) peristalsis, of which tone is myogenic and peristalsis neurogenic, depending on the integrity of the myenteric
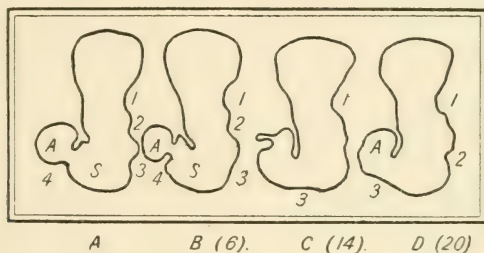
FIG. 13.—After Rieder. Changes of form during contraction: *A*, antrum; *S*, sinus; 1, 2, 3, 4, waves of constriction.

plexus and ganglia situated between its muscular coats. Tone and peristalsis are controlled by the extrinsic nerves—the efferent fibers of the vagi and splanchnics, and in addition to these, afferent fibers run from the submucous and myenteric plexuses, in the vagi and splanchnics to the cord and medulla, proceeding upward by synapses and relays to the general subconscious emotional centres of the optic thalami. Both tone and peristalsis lie under the influence of the highest emotional states, the loci of which being within the cerebral cortex. As we learn from Carlson's work the gastric mucosa is endowed with protopathic heat and cold sensibility and with protopathic appetite sensibility running into it from the submucous plexus.

3. DESCRIPTION OF MOVEMENTS. The movements commence on the greater curvature of the corpus, just below the cardiac notch (Home's point), and proceed as a slowly recurring series of annular constrictions becoming deeper as the pylorus is neared.

[1] Lancet, 1915, i, 650.

In Fig. 13 (*A*) four successive waves may be counted; *B* represents the condition six seconds later, and *C* and *D* after fourteen and twenty seconds respectively. In *D*, the stomach has reached the *A* stage and the antrum has expanded preparatory to the commencement of a new systole.

During the diastole, chyme will be drawn from the sinus, and, if the pylorus be open, pancreatic juice from the duodenum; if the pylorus be shut, the antrum contractions will drive the chyme back into the sinus. The antrum, on account of its quite apparent importance, has been termed the "motor" of the stomach, and it may be compared to the ventricle of the heart, the sinus to the auricle, and the cap to the aortic bulb.

4. ACTION OF VAGUS AND SPLANCHNICS. These nerves generally perform opposite functions, and conditions of vagal and sympathetic
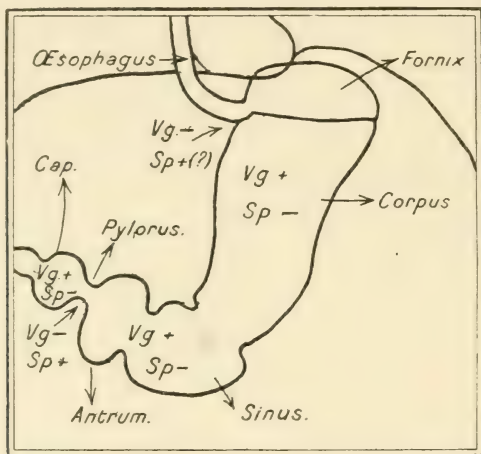
FIG. 14.—*Vg* +, vagus contraction; *Vg* −, vagus relaxation; *Sp* +, splanchnic contraction; *Sp* −, splanchnic relaxation.

hypertonia are described depending on which nerve possesses an ascendency in the production of symptoms. Vagopathic subjects are more likely to suffer from gastric hypertonicity, antral spasm, hyperacidity and from spasm of the duodenal cap, while splanchnopathic subjects exhibit sluggish digestion, delayed emptying time of the stomach, pyloric spasm, and gastric ectasia.

EFFECT OF VARIOUS PROCEDURES ON THE EMPTYING POWER OF THE STOMACH. As Neilson and Lipsitz[1] truly say, "It is surprising to find how many accepted facts concerning the emptying power of the stomach are conclusions, correct or otherwise, which have existed for so long that they are taken for granted as true, without experimental foundation." The authors propose to show the effect of exercise, massage and rest,

[1] Journal of American Medical Association, 1915, lxiv, 1052.

the influence of posture, the influence of temperature, the influence of the reaction on gastric motility.

After moderate exercise and rest, the stomach seems to empty more rapidly than when the individual is absolutely quiet. Massage and strenuous exercise bring about rapid emptying, and it is evident that in cases of gastric and intestinal indigestion exercise is contra-indicated. On the other hand, it should be beneficial in individuals with gastric atony or in those with dilatation and gastroptosis.

Posture has some influence on the emptying time of the stomach. Lying on the left side materially diminishes gastric motility, while the right side position favored the emptying. Clinically, it might seem that in cases with excessive gastric motility, lying on the left side would be indicated, while in that with atonic dilatation, fermentative conditions and ptosis, the right side position would favor more rapid emptying.

The effect of the temperature of the liquid is but slight, while the reaction has a decided influence. Normal acidity causes a more rapid emptying than artificially produced hyperacidity, and artificial alkalinity causes the stomach to empty less rapidly than under normal conditions, but more rapidly than during hyperacidity.

Sensibility of the Gastric Mucosa. Pain and Tactile Sensibility. Carlson and Braafladt[1] have confirmed on their gastric fistula case, Mr. V., the observation of numerous observers that the normal gastric mucosa is insensible to pain. Gently stroking the mucosa produces no sensation, and even pin-pricks or incisions do not seem to affect consciousness in any way. The authors do not deny that stimulation of a hypersensitive mucosa, such as encountered in gastric ulcer, may cause pain, but they have no personal observation on this point.

Temperature. It has been claimed that the sensation of heat and cold, following the ingestion of hot or cold water, arises from the lower end of the esophagus, but Carlson and Braafladt believe that this and other theories as to the production of sensation of temperature are untenable. They insist that the gastric mucosa is endowed with pro-topathic temperature sensibility. Using Mr. V. again as a test object, hot and cold water was introduced, the subject being carefully blind-folded. With water at 50° C., heat sensation was felt after a latent period of about five seconds. At 10° C. a cold sensation was felt, after a slightly shorter latent period. Experiments similar to these were tried on themselves by Carlson and Braafladt, the results of which corresponded exactly with those on Mr. V. There seems from these studies that the stomach mucosa is endowed with heat and cold nerve endings, the fibers being of the protopathic type.

Sensation of Appetite. Carlson again confirms his previous con-clusions, to wit, that the hunger sensation is initiated by strong

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[1] American Journal of Physiology, 1915, xxxvi, 153.

contractions of the stomach wall, and can not be aroused by any kind of stimulation of the nerve endings in the gastric mucosa. The hunger sense, therefore, lies in the muscular coats or in the connective tissue, but not in the mucosa, and is a complex of tension and pain. A distinction must be made between appetite and hunger, which are qualitatively different sensations. Carlson believes that although the sensory apparatus for hunger is distributed in the stomach wall, the hunger contractions themselves may be started by stimulation of certain nerve endings in the mucosa. In other words, although the gastric mucosa has no hunger sensory apparatus, it has a protopathic appetite sensibility, by the stimulation of which hunger contractions and hunger sensations may be aroused.

SENSATION OF FULNESS. This sensation does not arise in the mucosa, and although it is true that "the sensation of fulness in the stomach is due to tension on its muscular coat, and depends very little and only in extreme cases on the stretching of the abdominal wall" (Hertz), Carlson and Braafladt contend that, in addition, there must be a certain amount of tonus relaxation of the stomach before the sensation of fulness can be produced.

APPETITE AND PATHOLOGY OF APPETITE. There is a very interesting article in the *Archiv f. Verdauungskrankheiten*, 1914, xx, p. 469, by Sternburg, which is deserving of some attention, inasmuch as he endeavors to study the relation between dietetics and the physiology of sense as it refers to appetite. For the proper understanding of the origin of appetite, it is important to have in mind the fundamental truths, which seem to be continually lost sight of in dietetics or in the study of nutrition.

Appetite. 1. Appetite is a sensation, a general sensation, having its physiological substrate in the chemosecretory apparatus of the stomach.

2. Appetite is the will or desire to take nourishment; it is therefore a physic sensation preceding a physiologic function, the latter operating in the future. The physic general sensation of appetite has, as a result, a remote action, the taking of food.

3. For the taking of the food, an act which the general sensation of appetite brings about, only one part of the body is involved, namely, the buccal orifice.

4. Appetite must be regarded as a premonitory sign.

5. The senses exert a great influence on this physic pre-sensation of appetite and on the physiologic effect of this sensation, namely, the later taking of food. The far-removed senses are important, but the near-at-hand senses even more so. These senses are:

Chemical "Fernsinn" (far sense)	Smell
Chemical "Nahsinn" (near sense)	Taste
Physic "Fernsinn"	Sight
Physic "Nahsinn"	Touch

These four senses are included in the word taste, and the appetite is nothing more than the will to taste.

6. Appetite is a premonitory sign of the desire to take solid food, and it is apparent that one can have no appetite of anything which he has as yet not tasted.

7. The origin of appetite is incomprehensible without calling to assistance another general sensation, namely, nausea and loathing. (nausea and tedium).

Nausea. 1. Nausea is a general sensation.

2. It is the will, the wish, or the need to empty the stomach, to rid one's self of food. It is a premonitory symptom, having for its end effect vomiting, just as appetite has for its effect the taking of food.

3. One must distinguish between two different conditions when either appetite or nausea is discussed. One says in general that a patient has regained his appetite, but in particular, says he has appetite for something. So with nausea, there is a nausea for everything or a nausea for something special.

4. The same senses, near and far, spoken of under appetite have a role in the production of nausea.

5. Appetite and nausea are as diametrically opposed to each other as the two poles. Nausea is the highest degree of "appetitelessness," if I may coin a word to correspond with the German "Appetitlösig-keit." In taking food as a result of appetite there is a negative, while in getting rid of it as a result of nausea there is a positive, pressure.

Sternburg distinguishes three different degrees of pathologic changes of appetite.

(*a*) Hyperorexia—the condition in which the appetite is intensified to a state of passion, a food lust.

(*b*) Anorexia—the zero of appetite.

(*c*) Parorexia-tedium-nausea. A condition in which the appetite has sunk below this zero of anorexia and is approaching the negative nausea.

The practical points brought out by Sternburg are these:

(*a*) In hyperorexia, just as in obesity and in dipsomania, the extreme opposite condition is to be sought for, namely, parorexia, and this he attains by his obesity cure.

(*b*) In treating anorexia, one has to be particularly careful not to increase this condition to the point of parorexia. Neither artificial food preparation or medicine is able to bring back lost appetite. The only way to arouse the appetite is by stimulating it by tasty foods carefully prepared and daintily served.

(*c*) Parorexia must not be increased to the point of actual vomiting, and no medicine should be given.

Gastric and Duodenal Ulcer. It has been contended by internists, and this view is undoubtedly shared by many surgeons, that surgical

interference is indicated in many cases of gastric and duodenal ulcer, but not in all, that when gastro-enterostomy is performed it should be accompanied by pyloric exclusion, but above all, gastric and duodenal ulcers are in certain stages medical conditions and should be treated medically. Only when complications arise should a surgeon be consulted. Another question, often raised, is the postoperative care of such patients. The surgeon frequently considers his work finished when the patient is discharged surgically "cured," and fails to recognize that these patients are not cured in the sense that they are free from symptoms, but that after a time symptoms may return which fill the patient's mind with skepticism as to the advantage of having had the operation performed. The postoperative treatment of a surgically treated case of ulcer is medical, and these patients should be under the care of the internist following the operation. A stomach which has been rebelling for years against the presence of an irritation in the form of an ulcer cannot, in two or three weeks after operation, have adjusted itself to another abnormal condition in the shape of a gastro-enterostomy, and the patient with such an altered gastro-intestinal apparatus cannot be regarded as cured, even if he is symptomless at the end of his short hospital sojourn.

Hamburger and Leach[1] have attempted to follow up the postoperative history of cases, and have deduced interesting conclusions. In cases with stasis, or hypersecretion, which are definite surgical indications, a simple gastro-enterostomy is liable to convert the normal gastric function into an abnormal one. If stasis and hypersecretion are present, gastro-enterostomy again fails if the pylorus is not excluded. If the pylorus is untouched, functional changes are prone to occur, no doubt due partly to pylorospasm and partly to hypersecretion. In cases with delayed motility and hypersecretion, gastro-enterostomy plus pyloric exclusion reduces the motility to normal and lowers materially the hypersecretion.

The inference is logical, therefore, that, in cases of non-relief following operation, the surgical indications have not been closely enough studied, and surgical procedures have not been properly devised to meet the individual case. Hamburger and Leach also lay part of the blame for the non-relief following operation on the physician in charge for not having made thorough and prolonged use of the medical means at his disposal, prior to operation, and for not having subjected the patient to prolonged postoperative medical treatment.

The cases of ulcer, duodenal or gastric, which I have had under my care have been instructed to report to me at bi-monthly or monthly intervals. Diet has been carefully watched, the routine of their daily life has been closely inquired into, and frequent stool examinations

[1] Journal of American Medical Association, 1915, lxiv, 1745.

have been made. I have been gratified with the results obtained, for it has been my good fortune, part of which resounds to the credit of the surgeon, of course, to have seen practically no cases fail to be relieved (may I say cured?) after operation.

GLUZINSKI'S TEST FOR GASTRIC ULCER. The hypothesis on which this diagnostic method rests is: An ulcer situated in the pyloric region and causing retention is accompanied by hyperacidity, while a cancer is attended by a mucous catarrh which causes a disappearance of the free hydrochloric acid. During the transformation of an ulcer into a cancer, free hydrochloric acid will be found up to a certain stage, but during the progress of the mucous catarrh there will occur a secondary insufficiency which may be demonstrated by giving two test meals. Gluzinski examines the gastric contents, first, from the fasting stomach; second, after test breakfast of a white of an egg, boiled, and 200 c.c. of water, the contents being removed in three-quarters of an hour: third, three and three-quarters of an hour after a test dinner, consisting of beefsteak and 250 c.c. of water. The stomach is washed out before and after the first meal and the second meal is given immediately after the second washing. In ulcer, the breakfast as well as the dinner give distinct reactions of free HCl; in beginning cancer the first meal will give a distinct reaction of free HCl while the second one will show only a slight trace, or the free HCl will be absent altogether.

Nicolaysen,[1] from whose article the foregoing has been copied, has employed this method in twenty-five cases of gastric ulcer, nine cases of duodenal ulcer, twenty-one cases of gastric cancer, fifteen cases of gastro-enteroptosis, eleven cases of chronic appendicitis, and five cases of gall-stone. All the diagnoses were controlled by operation. The author seems not to be tremendously enthusiastic about the method, except that he recommends it as a good means of testing the secretory functions of the stomach.

GASTRIC ULCER CURE. Believing that if the ulcer can be protected from the corrosive action of the gastric juice, Sippy[2] suggests a treatment conducive to rendering the free hydrochloric acid neutral and the gastric juice inert from 7 A.M. until about 10.30 P.M., or during the entire time that food and the accompanying secretions are in the stomach. By doing this the conditions for the healing of peptic ulcer are about as ideal as they can be.

The patient remains in bed for from three to four weeks. Unless there is some serious complication, he may be permitted to return to work at the end of four or five weeks. Three ounces of a mixture of equal parts milk and cream are given every hour from 7 A.M. to 7 P.M. After two or three days, soft-boiled eggs and well-cooked eggs are gradu-

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[1] American Journal of Surgery, 1914, lix, 821.

[2] Journal of American Medical Association, 1915, lxiv, 1625.

ally added until at the end of about ten days the patient is receiving approximately the following nourishment each day: Three ounces of the cream-milk mixture every hour from 7 A.M. to 7 P.M.; in addition, three soft eggs, one at a time, and nine ounces of a cereal, three ounces at a time.

Cream soups, vegetable purées, and other soft diet may be introduced from time to time for variety's sake. The total bulk at any one feeding must not exceed six ounces, and the patient should be weighed so that if he does not gain from two or three pounds each week the good may be increased. The basis of diet should be milk, although jellies, marmalades, custards, creams, etc., may be used. Lean meats are not given as they interfere with tests for occult blood. By feeding every hour Sippy claims that the free hydrochloric acid·is completely neutralized, although he gives a powder of 10 grains each of heavy calcined magnesia and sodium bicarbonate midway between feedings.

The results claimed for this treatment by Sippy are astonishing, duodenal as well as gastric ulcers being cured thereby. Surgical assistance is sought only when the following complications are present; perforation, perigastric abscess, and secondary carcinoma.

PROGNOSIS OF GASTRIC ULCER. "The clinical course of any gastric ulcer is highly individual. While it is true that we have undoubted histologic proof that many ulcers heal, we have yet no means of determining clinically, in a given case, whether or no such an ulcer will heal in its acute stage, will tend to benign chronicity, or will become the basis of a future cancer. It is reasonable to suppose, however, from the mass of data, carefully studied, which has accumulated during the past decade, that many gastric erosions and simple ulcers have a natural tendency toward healing. This not uncommonly occurs irrespective of the clinical type of treatment that is carried out. It is also a commonly observed fact that a given ulcer will tend to chronicity and recurrence in spite of all known methods of therapy. In such cases, prognosis is largely dependent upon intensely individualized pathology. If the process continues benign, the resultant condition demanding treatment is largely accidental. Pyloric stenosis with gastric dilatation, hour-glass contraction, perforation involving other viscera, or malignant degeneration may occur without regard to our clinical care. Each case is a law unto itself. In many instances of chronic gastric ulcer, the ulcer itself heals, but, in the healing, complications occur which generally require surgical treatment.

"We have no known means of telling clinically in any case of gastric ulcer, and particularly in those cases which run a chronic course, what the ultimate outcome will be. The life history of the affection seems to depend upon unknown factors. It is coming to be more generally recognized, however, that gastric ulcers of the chronic type which have

a tendency to frequent recurrences not uncommonly terminate in malignancy. We do not know how often such a transition takes place. It should not be understood that all chronic gastric ulcers become malignant. It should, however, be firmly emphasized that, in a given chronic gastric ulcer, we have at present no means at our command that enable us to tell which chronic ulcer is destined to pursue a benign course and which will become malignant.

"The future course of chronic gastric ulcer is dependent wholly upon tissue reaction to hyperplasia. When the clinical pathologist is not uncommonly unable to differentiate between benign and malignant hyperplasia, it is very difficult to see how the internist is to be expected to prognose the future course of any gastric ulcer. Certainly, from our studies of gastric cancer, it would seem that more cases of this affection developed from previous benign ulcer than has heretofore been recognized.

"In a recent study we analyzed 566 consecutive cases of operatively and pathologically proved gastric cancer. We showed that the sex ratio in these cases was approximately that of chronic gastric ulcer; that the average history of the affection before evident malignancy occurred extended over 11.4 years in two out of three cases; that the supervening period of evident malignancy averaged 6.1 months; that but one out of three cases of gastric cancer had no previous dyspeptic history; their whole course averaged 7.1 months; that of the entire series, in 92 cases where hemorrhage had been noted the bleeding occurred in nearly 63 per cent. of those with previous ulcer history, and that of the whole number bleeding, 52 per cent. had bled two years prior to their coming under observation; that of those who bled within the two-year period, 77.5 per cent. fell into that group with ulcer history previous to a period of evident malignancy; that in but 55.4 per cent. was free HCl absent in the gastric extract, and that in 31.5 per cent. it ranged between 20 and 50.

"While the above facts are not to be taken as an indication that the majority of chronic gastric ulcers become malignant, they certainly indicate that the accuracy of our prognosis of the future course of any chronic ulcer is highly limited and frequently impossible. While malignancy supervenes often enough wholly irrespective of our methods of treatment, it is irrational to state that therapeutic measures which keep the stomach clean bacteriologically and which tend to minimize sources of tissue irritation, should be thoroughly carried on so long as surgical complications have not occurred, or a continuous and progressively downward affection has succeeded one which was before periodic and without symptoms of malignant intoxication. When in doubt as to the actual pathology existing in a given case, patients should be urged to submit to laparotomy; for it should be remembered that the cases of gastric cancer early diagnosed and surgically curable are those in

which the clinical symptomatology is that which we associate with chronic gastric ulcer" (Smithies[1]).

EXPERIMENTAL PYLORIC STENOSIS.   A study of the effects of pyloric stenosis in dogs has been made by Hamburger and Friedman.[2]   Three degrees of obstruction were induced, moderate stenosis, marked stenosis and complete stenosis, and the animals were grouped in three classes corresponding to the amount of obstruction.

The animals which had but *moderate stenosis* showed no loss in weight and exhibited no cachexia: they ate their food well, without apparent discomfort, grew fat and sleek, and seemed in better health after the operation than when they came to the laboratory.   After test meals a slight increase in total quantity and total acidity was seen; these findings demonstrate the resisting powers of the dog's stomach to a moderate degree of stenosis and are most interesting.

The animals with *marked pyloric obstruction*, showed greater changes in gastric motility and secretion.   They appeared ill at ease, grew thin and emaciated, food was refused, they later became toxic and finally died in from three to eight weeks of inanition and toxemia.   There was a marked increase in the gastric contents, due to food residue, but particularly to hypersecretion.   The acidity was generally lower after operation than before.

After *complete obstruction* the animal died in from forty-eight to one hundred and twenty hours.   A few refused food, vomited what little water they received, and succumbed from inanition and weakness. A few dogs developed symptoms of tetany and died within five minutes, while most of the dogs were found dead in their cages, having been in fair condition the previous night.

The result of the stenosis is motor insufficiency with food retention, which in turn induces hypersecretion, all of which Hamburger and Friedman believe to be important factors in the production of chronic pyloric ulcer.   Further on I have abstracted a second article of these authors wherein local destruction of the gastric mucosa was brought about in these animals with experimental stenosis.

EXPERIMENTAL CHRONIC GASTRIC ULCER.   Acute ulcers have been produced in dogs by three different methods:

(*a*) Infections.   By the intravenous injection of streptococci, staphylococci, Bacillus coli, pneumococci, and by introducing bacteria by the mouth.

(*b*) Toxic.   The toxic methods have been either general (injection of diphtheria antitoxin) or local, by injecting silver nitrate, epinephrin, formalin, nicotin, into the walls of the stomach.

(*c*) Mechanical.   Excision of pieces of mucosa, tying off gastric arteries, and injecting various substances into gastric vessels.

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[1] Ohio State Medical Journal, February, 1915.
[2] Archives of Internal Medicine, 1914, xiv, 722.

In their studies, Friedman and Hamburger[1] selected the injection of silver nitrate into the submucosa as the surest method, using from 0.5 to 1 c.c. of a 5 per cent. solution. These injections produce necrosis of the wall, leaving ulcerated areas in from forty-eight to seventy-two hours. Perforations are frequent, hemorrhages much more seldom. In normal stomachs, healing takes place in from two to three weeks.

Friedman and Hamburger simulated in dogs the hyperacidity usually seen in human gastric ulcers, by causing pyloric obstruction (see preceding pages) of 16 animals, the average total acidity before pyloric obstruction was 34, while the average after such obstruction was 50. The quantity of stomach contents removed increased, from 100 to
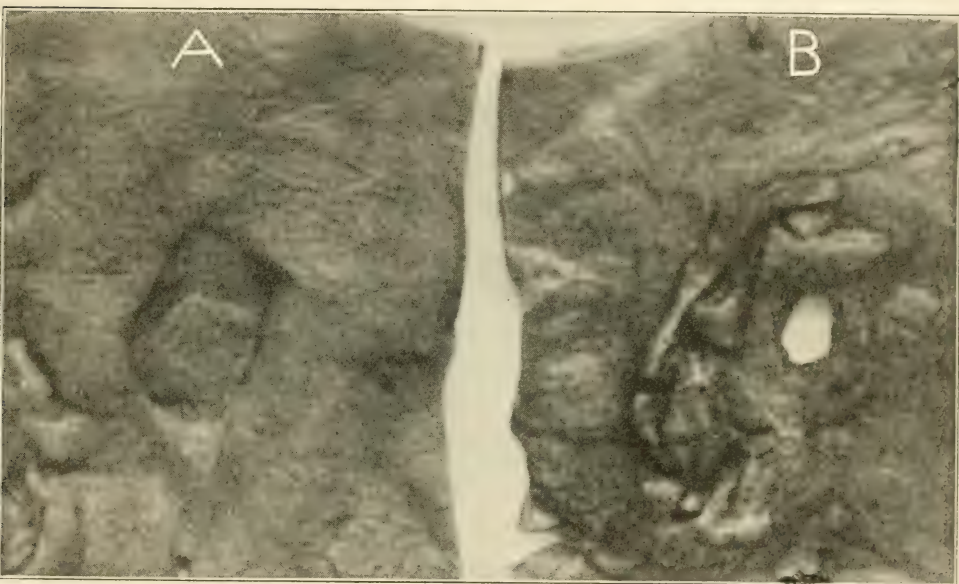
Fig. 15.—Acute ulcers, eight days after second operation.

350 c.c. before operation, to 1000 c.c. after obstruction. The authors have found that whereas simple acute experimental ulcers heal rapidly in two or three weeks, ulcers in dogs which have pyloric obstruction have a tendency to become chronic.

Consequently at least three factors are necessary for the production of chronic ulcers in animals; first, a local destruction of the mucosa, second, an active or ever active gastric juice, and third, prolonged or vigorous contact of the two (hyperperistalsis). These factors result in the irritation of the floor and of the sides of the ulcers, with scar formation (callous ulcer) or else there is further digestion of the inflamed tissue, resulting in the production of the progressive gastric ulcer.

[1] Journal of American Medical Association, 1914, lxiii, 380.

Applying these facts to man, Friedman and Hamburger say the first step in ulcer formation is the digestion of the mucosa. Since this never occurs normally, the tissue must first have been injured in some way—emboli, burns, uremia, trauma, or by any of the processes which cause gastritis. As far as the second factor stated above is concerned, "an active gastric juice," they feel that there is no reason why ulcers should not be produced by normal acid juice acting on diseased tissue if other factors are present. The third factor, hyperistalsis, is clinically present in a majority of cases of ulcer, and the authors quote Smithies as finding abnormal food retention in 65.3 per cent. of ulcers. Abnormally vigorous contact as a furtherance to autodigestion is supplied

Fig. 16.—Chronic ulcer five weeks after second operation.

by the pylorospasm and by the spasmodic hour-glass contractions, both of which increase the friction of the food particles. Indeed, Friedman and Hamburger have found that the end of an ulcer toward the pylorus, is generally deeper than the other portions.

As a working hypothesis the authors suppose that acute ulcerations arise in the stomach from some outside cause, resulting reflexly in pylorospasm, which in turn causes impaired motility, hypersecretion, and hyperstalsis, both inducing chronicity; or that various conditions in the gastro-intestinal tract reflexly cause spastic contraction of the various parts of the stomach, with the narrowing of the lumen. If an abrasion occurs at the narrowed portion, from a coarse particle of food,

the same digestive processes cause chronicity and the ulcer perpetrates the spasm.

EXPERIMENTAL PRODUCTION OF ULCER. Friedman[1] has produced ulcer after removal of adrenals, thyroid lobes, injections of thyroid and adrenalin, but the findings after simultaneous removal of adrenal and of one lobe of the thyroid were negative in the stomach and duodenum. It seems that the influence of adrenal insufficiency is possible only with the thyroid intact, hence there must be an antagonistic relation between the adrenal and thyroid lobe. The essence of Friedman's work is, that there is a dependence of ulcers upon the disturbance of internal secretions, but he takes pains to insist that these findings do not deny that other causes may be operative in the production of similar lesions.

ANEMIA A FACTOR IN EXPERIMENTAL ULCER. Crescimone and Anglesio[2] induced anemia in dogs by daily subcutaneous injections of 1 per cent. solution of pyridin, and by the tenth day the hemoglobin had dropped to 25 to 30 per cent., and the red cells to about 2,000,000. The anemia continued a progressive course, the animal dying between the tenth and forty-fourth day. In 15 of the 16 animals, lesions were found in the stomach or duodenum or both, and nowhere else. These lesions displayed the characteristics of peptic ulcers, and the authors regard them as analogous to the first stage of chronic ulcer in man. In some of the dogs the vagus had been severed, and this seemed to aggravate the lesions. The experiments reported and the literature reviewed seem to sustain the assumption that an anemic condition is an important factor in gastric and duodenal ulcer and that treatment of the peptic ulcer should not disregard the underlying anemia.

EFFECTS OF ANEMIA IN ACUTE GASTRIC ULCER. It has been believed for a number of years that anemia plays an important role in the production of acute ulcer, and this view is still held by many writers (see preceding). There is both clinical and experimental evidence pointing to the correctness of this hypothesis, though it must be said that the former is not wholly conclusive, and, according to Bolton,[3] the latter is not very weighty. Poisons were used to cause the anemia and no regard was paid to the diet, two objections which he makes to accepting the results based on early animal experimentations. The main questions to be solved are: (1) Does anemia exert such an effect on the gastric cells that the production of an ulcer is facilitated; in other words, will an ulcer in anemic states be more extensive than one produced similarly in a healthy animal? (2) Does anemia affect the vitality of the mucosa and the connective-tissue base of an ulcer so that the gastric juice causes

[1] Journal of Medical Research, 1915, xxxii, 287.

[2] Abstract, Journal of American Medical Association, 1915, lxiv, 286.

[3] Quarterly Journal of Medicine, 1914, viii, 19.

spreading laterally or in the depth of the ulcer? (3) Does anemia interfere with the healing of the ulcer?

Bolton produced ulcers in cats by using gastrotoxic serum, and then bled them to induce anemia; control experiments were always made. The whole series of experiments showed that when an animal, the subject of an acute gastric ulcer, is placed on a milk diet, so that its stomach empties rapidly, healing of the ulcer goes on at the same rate whether the animal is anemic or normal. When once the slough has separated from the base of the ulcer and healthy granulation tissue has commenced to grow, the ulcer in the anemic animal is no more vulnerable to the action of the gastric juice than is the mucous membrane of the normal animal. Anemia has no influence in the production of an acute gastric ulcer; nor in causing such an ulcer to extend laterally or in its depth by increasing the vulnerability of the tissues concerned; nor in preventing its healing either by interfering with the regenerative power of the surface epithelium or of that of the granulation tissue of the base of the ulcer. When the anemic animal is allowed meat to eat, any delay in the healing is due to the diet of that animal and not to the anemia. Bolton says that all these experimental facts are in accord with his personal clinical observation.

ULCER OF LESSER CURVATURE OF THE STOMACH. Borgbjaerg[1] analyzes his experiences in 48 cases of pyloric ulcer, 13 of duodenal, and 27 of ulcer of the lesser curvature. By means of the x-ray, an ulcer in the lesser curvature is now readily diagnosed. Periodic recurrence of the pain was present in 78.6 per cent., but only in 14.3 per cent. was there hypersecretion. Acidity was normal in 42.9 per cent. and below normal in 28 per cent. There was no pronounced retention of stomach contents in any case, and the emptying time of the stomach was normal in 50 per cent., and but slightly delayed in 28.6 per cent. At times there was vomiting, but this was slight and occurred soon after eating, and at times consisted of mucus only. Hematemesis and melena were also seen occasionally.

The most constant and characteristic symptom was pain in the cardiac region sooner or later after eating, coming on early with hypersecretion and later with subacidity. From the clinical symptoms alone it is impossible to determine the location of the ulcer or even if there is an ulcer. In his series of cases, the disturbances were ascribed to everything but the right cause, and futile treatment had long been applied for the assumed neurasthenia, hysteria, colitis, or gastroptosis. One or more of these affections may actually accompany and overshadow the ulcer. The patients grow more and more nervous as their general health is suffering from the ulceration, and the various measures applied fail to relieve their symptoms.

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[1] Abstract, Journal of American Medical Association, 1915, lxiv, 1804.

Localization of the pain in the lesser curvature region is instructive as is also tenderness at this point. In order to avoid suggesting this tenderness, Borgbjaerg begins to apply pressure at a distance and gradually works up to the suspected point. Suspicious clinical findings become certainties when confirmed by the Röntgen rays. He found pronounced circumscribed pain on pressure in two-thirds of his 27 cases of ulcer on the lesser curvature, and 71 per cent. of his uncomplicated cases. This tenderness is particularly suggestive when it is at the left of the median line.

Verbrycke[1] has had 25 cases of ulcer, about the same number of cases as Borgbjaerg. Pain, in ulcer of the lesser curvature, is not apt to be as severe or as characteristic as that seen in pyloric ulcer, and no reliance can be placed on the time of appearance of the pain as an indication of the location of the ulcer. Vomiting occurs, due to the irritative effect of the ulcer, but is not seen in every case, although nausea is a very common symptom, as are also pyrosis and heartburn. Periodicity of symptoms is not as frequent a sign as in chronic pyloric or duodenal ulcer.

Of greatest value are local tenderness in the midepigastrium, and the presence of occult blood. Radiography discloses the presence of ulcer but is of doubtful aid in localizing the same.

RELATIONSHIP OF GASTRIC ULCER AND GASTRIC CARCINOMA. Of the 399 cases of gastric cancer in the Mayo clinic, 4.8 per cent. showed ulcers with doubtful cancer in the border, 15.8 per cent. showed ulcer with positive early cancer in the borders only of the lesion, while 42.8 per cent. show cancer in which the evidence of previous ulcer formation is doubtful. These 399 cases comprised those from which the ulcer was resected at the time of operation.

Of the 46 cases of cancer, 1 case (2.2 per cent.) showed an ulcer with doubtful cancer, 7 cases (15 per cent.) showed ulcer with advanced cancer, while in 38 cases (82 per cent.) the evidence of ulcer previous to cancer formation is doubtful (Wilson and McDowell[2]).

Wilson concludes, from a study of the clinical and pathologic evidence of his cases, that gastric cancer rarely develops except at the side of a previous ulcerative lesion of the mucosa.

Gastric Cancer. Friedenwald[3] has analyzed most thoroughly 1000 cases of cancer of the stomach. He concludes that the early diagnosis of carcinoma is usually difficult, for the most important symptom may be absent even though the growth is of considerable size. The presence of a palpable tumor is the most important sign of cancer, although the author properly recognizes the fact that in no sense is it an "early sign," as in 60 per cent. of the cases it makes its appearance six months after the beginning of symptoms. The absence of hydrochloric acid is

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[1] Medical Record, 1914, lxxxvi, 191.
[2] American Journal of Medical Sciences, 1914, cxlviii, 796.   [3] Ibid., 660.

a frequent sign (89 per cent. of cases), yet as this condition is present so often in other conditions as well as in cancer it is not a particularly valuable sign.

Signs of pyloric obstruction are at times noted, and, when present, are of great importance. Friedenwald finds that 92.5 per cent. of his cases manifest fecal occult blood, and he says that when the test is continuously positive it has much significance.

Twenty-three per cent. of his 1000 cases gave the history of previous digestive trouble, but only 7.3 per cent. gave a direct anamnesis of ulcer. If, therefore, one wishes to consider all digestive symptoms as indicative of ulcer, the formation of cancer could not have taken place in more than 23 per cent. He believes, from a purely clinical point of view, that Wilson's statistics (see above) are too high, and doubts very much if malignant degeneration of an ulcer takes place in more than 23 per cent. of the cases, and possibly in not so large a proportion.

Gastric Cancer in the Young. In 721 cases of pathologically demonstrated cases of cancer, Smithies[1] found 16 instances in individuals under thirty-one years of age, or a percentage of 2.2. There were 9 females and 7 males, the youngest patient was eighteen, the oldest just past thirty. In two instances there was a family history of cancer. Two cases belonged in a group which included cases in which there appeared a gastric affection, pernicious in nature and progressively downward in course, in patients in whom there had been no previous gastric ailment. Fourteen individuals were in a group comprising cases in which there had been gastric complaints which one clinically calls "peptic ulcer."

The appetite was poor in 6 cases, while in the remaining cases it was uniformly fair. All cases exhibited constipation. Loss of weight in the 14 cases in group two above was seen only during the exacerbations of the digestive trouble, while in the 2 individuals in group one it was rapid. Every patient complained of abdominal pain or distress in some degree, and in all instances there was tenderness on palpation. Tumor was palpated in but 6 cases (38 per cent.), and vomiting, with or without nausea, was observed in all the cases at some time, usually in the terminal stage, in the course of the disease.

There was always secondary anemia. In 62.5 per cent. of the cases the stools contained blood. After test meals, in 11 cases, motility was interfered with, and there was retained food at the end of twelve hours. The average total acidity was 59, and the average free hydrochloric acid was 26. In one instance it was absent.

Nine patients died in one and one-quarter years following operation. To the other patients of this series a lease of life of from two to more than five years was granted.

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[1] Journal of American Medical Association, 1914, lxiii, 1839.

"Carcinoma in a Nine-year-old Boy" is the title of a paper by Karl.[1] Always of a spare build, the youngster first had gastric symptoms three months before operation—hematemesis, emesis, emaciation. Upon examination, there was a palpable tumor at the right of the umbilicus. The specimen removed at operation was examined by Orth and pronounced carcinomatous in nature. Four months after operation the boy seemed quite well and weighed twice as much as before surgical interference.

FAMILIAL GASTRIC CARCINOMA. Pel[2] reports a family of seven children, five of whom had gastric carcinoma.

LABORATORY TESTS FOR CARCINOMA. *Van Slyke Amino Nitrogen.* The essentials of this method are the determination of amino nitrogen in cancer serum alone and in cancer serum plus cancer substrate. After measuring the amount of amino nitrogen liberated from the serum alone, and then measuring the amount of amino nitrogen liberated from the serum plus substrate, it is found that the amount of the latter is increased over the latter by anywhere from 0.05 to 0.15 c.c. This increase depends on the presence in the suspected serum of a proteolytic ferment.

Lowy[3] has tested out 82 cases, of which 42 were clinically and pathologically diagnosed as cancer. Positive reactions were obtained in 83.3 per cent. and negative in 16.7 per cent. In the 40 non-cancerous cases, 15 per cent. were positive and 85 per cent. were negative. Lowy believes the Van Slyke amino nitrogen method is more satisfactory than the Abderhalden method, although he admits that percentages based on such a small number of cases are apt to be misleading and inconclusive. If this method is of use, it will be found to be much easier of application than the Abderhalden method, and removes many of the objections raised against the latter.

Robin[4] has studied the relation of ammonia nitrogen to amino nitrogen in 16 cases of cancer, and finds nothing to justify the hopes entertained by other investigators. The ammonia nitrogen seems to be increased in relation to alimentation or when there is an exaggerated destruction of albumin, while the amino nitrogen indicates nothing except an increased activity of the cancerous tissue and a rapidly progressive course of the disease. It is more marked in carcinoma of the digestive tract, but Robin denies to it all specificity in regard to cancer.

Colloidal Nitrogen in the Urine. This means of diagnosing cancer, already previously described in these pages, has been studied anew by de Bloeme, Swart, and Terwen[5] with but little important result. The authors suggest a modification, namely, that of dialyzing the zinc

[1] Deut. med. Woch., 1915, p. 373.
[2] Berl. klin. Woch., 1915, p. 288.
[3] Journal of American Medical Association, 1915, lxiv, 1559.
[4] Bull. de l'Acad. de Méd., 1914, lxxi, 761.
[5] Münch. med. Woch., 1914, p. 1718.

sulphate precipitate. According to them the non-dialyzable portion contains in carcinoma a marked increase of nitrogen over that in other conditions.

Wolff-Junghans Test. This test, consisting of the estimation of the amount of albumin in the filtrate of gastric contents after a test meal, has been studied by Trallero[1] with a view to differentiating achylia gastrica and cancer of the stomach. Eighty cases were studied, and, in addition to the quantitative albumin examination, the stools were examined, and also careful x-ray studies were made. Only those gastric contents which contained no blood were investigated. Also tests for rennin and pepsin were made. As a rule the highest albumin figures, 320, were encountered in carcinoma and both rennin and pepsin were diminished. Not every cancer has, however, these high values, as certain unmistakable tumors had normal amounts of albumin. In cases of chronic gastritis, large quantities of albumin were found together with low ferment amounts. In true achylia gastrica there are occasionally normal albumin figures. In 50 normal cases, albumin units up to 160 were found. In such cases Trallero believes there is a contamination with saliva which he has discovered gives amounts of albumin ranging from 160 to 320. These results appear to me to vitiate the conclusions of other observers, and the test is robbed of much of its value.[2]

Oxyproteic Acid. In cachectic carcinoma and tuberculous patients there is an increase in the oxyproteic acid nitrogen, but this finding is valueless from the stand-point of diagnosis as it is by no means a constant phenomenon. This is a contradiction to the previous statements of Salomon and Saxl, who emphasized the increase of the oxyproteic acids in carcinoma, and who regarded this increase as a characteristic of the disease (Sassa[3]).

Sulphur Reaction in the Urine. Capella[4] applied the Salomon-Saxl test in 21 cases of certain cancer, 11 with various other affections, and 5 healthy controls. He obtained a positive response in only 84 per cent. of the cancer cases, so he thinks the test of comparatively little differential value.

Potassium Iodide in Diagnosis and Treatment of Cancer. Michailoff[5] strongly recommends potassium iodide in internal cancer, preferably in the form of rectal injections (4 gm. potassium iodide, 2 gm. sodium carbonate, and 80 or 100 c.c. distilled water). This he supplements with 1 per cent. solution of sodium arsenate (sodium arsenici) hypodermically, which solution must be made with 0.25 per cent. phenol. He

[1] Deutsch. med. Woch., 1914, p. 1428.
[2] See PROGRESSIVE MEDICINE, December, 1914, p. 32.
[3] Biochem. Ztsch., 1914, lxiv, 195.
[4] Abstract, Journal of American Medical Association, 1915, lxiv, 476.
[5] Ibid., 1914, lxiii, 1145.

found that if the temperature rises one or two hours after the rectal injection of the potassium iodide, then we have positively to do with a malignant growth (carcinoma or sarcoma). If the temperature remains stationary or even declines, then cancer can be excluded and syphilis is probable. He sees in the action of potassium iodide in this respect an analogy to the action of tuberculin in tuberculosis, and claims that carcinoma can be cured in certain stages of malignant disease with this method of treatment. It reveals the presence of cancer, like the positive response to the tuberculin in tuberculosis, and a systematic course of treatment with it has curative influence like that of tuberculin (?).

He states that potassium iodide seems to display a special affinity for cancer cells in the test-tube, and his clinical experience apparently indicates that this is the case also in the human body. For the differential diagnosis he gives the rectal injection as above described, and repeats it after an hour or an hour and a half to a maximum of three injections, but one is generally sufficient. The temperature reaction becomes manifest in one or two hours. He does not give specific instances or figures, but relates that after his course of treatment with potassium iodide, supplemented by subcutaneous injection of a 1 per cent. solution of sodium arsenate, some of the patients are still living who had been told years before by leading clinicians that they had internal and hence inaccessible cancer. All his patients thus treated were in this inoperable class, as he always operates for accessible cancer.

Abderhalden Method as Applied to the Diagnosis of Carcinoma. Cytronberg[1] has employed this method in a large number of control and carcinoma cases, and regards it as highly specific. Certain errors have been encountered, the cause of which he was unable to determine. One presumable source of error he found to lie in the character of the dialyzing membrane, but, by using membranes which he was certain were perfect, he was able to control the percentage of error so well that he obtained positive results even in cases of the smallest skin cancers. A study of the protocols shows such an astonishing exactitude of results that one is forced to share the author's enthusiasm for the method.

Almost as enthusiastic as the above is Weinberg,[2] although he wisely warns that the reaction can in no wise supplant the clinical diagnosis, and although he too has encountered certain sources of error which are most unfortunate and inexplicable. Only by performing the test with scrupulous care and by a painstaking study of its results, and of clinical examination can it be entitled to the name of an "Early Test for Carcinoma."

In contrast to the above, a paper of Leitch[3] should be read. Of 100

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[1] Mitt. a. d. Grenzgeb., 1914, xxviii, 243.
[2] Münch. med. Woch., 1914, pp. 1617 and 1685.
[3] British Medical Journal, 1914, ii, 330.

cases tested to prove the worth of the method in the serum diagnosis of cancer, 51 were cancer and 49 were non-malignant. In the 51 cancer cases, positive results were obtained in 28, or 55 per cent.; and in the 49 non-cancerous controls, positive results were obtained in 18, that is, 37 per cent. The method, therefore, is without diagnostic value.

The author proceeds to comment on the adverse results here obtained, results which contrast so strikingly with those of Abderhalden and his disciples, that he cannot regard his finding as being due to errors of technic or to biassed misunderstanding. According to Leitch, the theory originated from the readings of some preliminary experiments. It may be that these readings unconsciously exaggerated the facts; the fundamental observations were not made sufficiently indubitable for a great structure to be reared on them; and the observer, having satisfied himself that a certain result was to be expected, and knowing exactly what he had to deal with when identical experiments were repeated, could not avoid obtaining readings similar to the original. Suppose the repetition of the experiments was entrusted to a disciple in the laboratory, as is often the case in a busy laboratory, there would be even greater chance of the original views being substantiated. Although this may be ungenerously supposititious, Leitch contends that the fact remains that the fundamental experiments do not cover a sufficiently wide field, and it is obvious to him that a great jump was made from serum reactions to substances quite foreign to the animal body, to serum reactions to substances natural to the body. The experiments with the serum of pregnant women, viewed through the eyes of the impelling theory, would at first seem to justify this jump. The same phenomena were found, and these were rendered all the more plausible since the serum of many non-pregnant individuals failed to give them. False results would crop up, however, as the number of the latter cases increased. Surprised at these, an enthusiast would seek causes for rejecting them. If all biologic laws were as dependable as the movement of the stars, then there would be little scope for the making of errors, and research would be unromantically monotonous. The unexpected false results would be associated with some accompanying phenomena, and a causal relationship would be assumed, so that on the recurrence of false results and their accidental association with such conditions, one would feel in a position to reject them. This seems to have been the history of the Abderhalden reactions.

In discussing the real fallacies of the test, Leitch first attacks the substrate. Abderhalden's direction that the fresh organ should be washed free of blood until a "snow-white tissue is obtained," he finds impossible of accomplishment. He even doubts if the presence of small traces of blood or very large amounts, for that matter, has anything to do with the false reaction. Also he finds the ninhydrin reaction as a test for protein to be extremely fallacious. Another source of error pointed

out by Abderhalden is that the connective tissue in the substrate may itself be attacked and broken down by some intruding ferment. If so, this reduces the reaction to a farce, for there is no organ devoid of connective tissues and no organic disease incapable of implicating them. Besides, the latest method adopted by Abderhalden, the pounding of the tissues in a mortar is calculated to get rid of much parenchyma and to leave as much connective tissue as possible.

Whatever theoretical objections may be brought against the reliability of the substrate that Leitch has used, he says the criticism quite loses its point if one can get false reactions with "substrates" that are beyond suspicion. He employed as "substrates" pieces of sterilized sponge, kaolin, and glass-wool, obtaining 7 well-marked, positive results in 39 serums tested, and he quotes Plaut as obtaining positive results when kaolin, barium sulphate, talc, and Kieselgur were used. "It will hardly be argued by the most ardent believer in the *Abwehrfermente* theory that protective ferments are elaborated within the animal body capable of splitting up into peptones or amino acids such substances as sponge, glass-wool, and kaolin."

Concering the serum, Leitch has this to say: Abderhalden has insisted that hemoglobin-stained serum should not be used, as the presence of hemoglobin indicates that the corpuscles have broken up and shed into the surrounding fluid their endocellular ferments, some of which are bound to be proteolytic. Leitch asserts, on the contrary, that the mere presence of hemoglobin does not give rise to reactions in the dialysate, for he has carefully noted the behavior of tinted serum in over 20 cases, and false positive reactions do not seem to be as frequent in these experiments as in the case of normally colored serums. The belief that the serum may produce false positive reaction if withdrawn from a patient within four hours after a meal is fallacious, and the objection is hypothetical. Leitch has examined blood when a minimum of six hours had intervened since the last meal, and also blood taken actually during or shortly after meals, and it does not seem to make the slightest difference.

Leitch has found, as did Cytronberg, that the dialyzation tubes are often imperfect and must be continually retested. He concludes that the real fallacies of Abderhalden's method are beyond control, and that the hypothetical fallacies which Abderhalden invokes to account for false reactions have no basis.

Schumkowa-Trubina[1] regards the reaction as not altogether specific, although it is positive in about 95 per cent. of carcinoma cases. Difficulties attending the method render it impracticable for common use, but its employment as an "early test" seems possible, although much more study will be necessary before its value is definitely determined.

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[1] Deut. Ztsch. f. Chir., 1914, cxxxi, 520.

Cobra Venom Test for Cancer. Farmachidis[1] gives an imposing array of tables showing the application of this biologic hemolysis test to 37 patients with carcinoma, 16 with sarcoma and 38 with various non-malignant affections. The findings are given for each of the twelve applications of the test in each case with rabbit serum and again for six applications with guinea-pig serum in 18 cancer and 14 non-malignant cases. He points to his tabulated findings as indicating beyond question that the cobra venom reaction is specific for carcinoma. With rabbit corpuscles, positive results were obtained in 86.48 per cent. of the carcinoma cases, and constantly negative in the controls. With guinea-pig corpuscles the reaction was positive in 100 per cent. of the carcinoma cases, and, with the exception of one dubious reaction in one case, constantly negative in the non-malignant controls. With sarcoma the cobra venom arrests the hemolytic action of the serum; with carcinoma it induces hemolysis; with non-malignant disease it has no influence on the behavior of the serum. He mixes the serum, the venom, and the blood corpuscles and keeps the mixture at a temperature of 20° C. for two hours, then places it on ice for twelve hours. The corpuscles are washed four times in salt solution and a 5 per cent. suspension in 0.85 per cent. saline is used in the test.

Biologic Tests for Cancer. Mioni[2] has been making a comparative study of various biologic tests, and states that the meiostagmin reaction proved positive in 57.1 per cent. of the 35 cases; Crile's hemolytic test was positive in 62 per cent., and in the negative cases the cancer was in advanced stages or a superficial growth so that the diagnosis was clinically beyond question. On the other hand, in most of the cases giving a positive response the cancers were in the viscera and many of them in the earliest stage of development. The fact that hemolysis occurs also in tuberculosis, etc., scarcely invalidates this test, as the clinical manifestations otherwise exclude mistakes as a rule. Elsberg's reaction was obtained in only 11.2 per cent. The antitryptic index was characteristically high in 91.4 per cent., and others proved its value as an aid in the diagnosis of cancer in dubious cases. The deviation of complement tests did not give reliable results in his hands, and passive anaphylaxis tests also proved uncertain. He remarks in conclusion that after excision of the cancer the various biologic tests all veered more or less promptly to a negative reaction.

Detection of Early Secretory Insufficiency as a Sign of Cancer of the Stomach. The diagnostic value of free hydrochloric acid in the gastric contents has been a matter of much debate. As an index of the secretory function of the stomach, Ehrenreich[3] believes it to be of little worth. In the first place the secretory activity may be very much

[1] Abstract, Journal of American Medical Association, 1915, lxv, 289.
[2] Ibid., 1914, lxiii, 980.   [3] Berl. klin. Woch., 1914, p. 1546.

impaired despite the presence of free hydrochloric acid or it may be
normal despite the absence of free HCl. In the latter case, excessive
amounts of mucus, or regurgitation of duodenal contents, can so neu-
tralize the normal amounts that none is detected. Again, the quantity
of free acid depends essentially on the kind of meal given and the time
it is removed. Even if all these things are carefully guarded against,
Ehrenreich thinks it is nevertheless an imperfect means on which to
base one's estimate of the secretory efficiency of the stomach. As a
sign of carcinoma it seems to be of little use, for more and more cancers
are reported with normal amounts of free acid, or with the acid values
but little impaired. This may be due in great part to the gain in greater
diagnostic acumen, but, nevertheless, instead of determining merely
the presence or absence of free hydrochloric acid in gastric cancer, the
problem should be how to recognize beginning changes in secretory
functions, and what value, diagnostically speaking, these changes have.

Ehrenreich claims that comparisons between the acidity of the
fasting stomach and that of gastric contents after a test meal have great
importance in formulating a judgment between carcinomatous and
benign conditions of the stomach. In carcinoma, the test meal con-
tents always show lower amounts of acid than the contents of a fasting
stomach, while in ulcerous conditions the opposite is the rule. A table
will illustrate this point.

Diagnosis.	Fasting.		Test meal.	
	HCl.	T. A.	HCl.	T. A.
Duodenal ulcer	36	44	56	64
Duodenal and pyloric ulcer	42	46	80	104
Pyloric ulcer	56	80	41	59
Pyloric ulcer	19	32	38	53
Pyloric ulcer	0	?	30	42
Pyloric ulcer	20	40	28	36
Gastric ulcer	4	12	16	44
Carcinoma	82	108	72	94
Carcinoma	0	68	0	28
Carcinoma	28	48	30	50
Carcinoma	16	52	0	12
Carcinoma	0	72	0	36
Carcinoma	32	82	0	28

The explanation of this is easy. We know that the fasting remains
are enough to stimulate the gastric mucosa to activity. When we remove
this, then give a test meal, we do not give a rested stomach a new
stimulus, but we give a stimulus to an organ which is already stimulated.
In other words, the stomach is subjected to two consecutive stimuli,
which in ulcer (attended always (?) by overproduction of acid con-
tents) reacts differently to that of a stomach whose secretory function
is already impaired by ravages of the disease.

As will be seen from the table, there are exceptions to this rule, and
Ehrenreich explains these away by saying that the food-rests in the

empty stomach are always the same, qualitatively or quantitatively, and that when they are too great the secretory function is so exhausted that it does not react to the second meal, even in the ulcer cases. If they are too few, no secretory stimulus is offered. By means of this method, Ehrenreich is convinced that early stages of carcinoma may be discovered.

Digestion Leukocytosis in Carcinoma and Ulcer. Owing to conflicting views, Bonhoff[1] was led to study the value of this very simple method in a number of cases. He agrees with other investigators that in health there is always a leukocytosis to be observed after eating, and offers the following figures as illustrative:

	Leukocytes.
Fasting, morning, 7 o'clock	6000
Before lunch, 12 o'clock	6500
Three and a half hours after lunch	9900
Six hours after lunch	7700

Bonhoff uses a mixed diet, and allows the patient to choose the kind of food he desires. Fourteen cases of cancer and 15 cases of ulcer were studied. In the former there was generally a fall of the leukocytes compared with those counted before the meal. In 14 cases the digestion leukocytosis (D L) was not observed, and in the cases collected from the literature it was missed in more than 90 per cent. of the cases. In the ulcer cases, on the other hand, with but a few exceptions a D L was always seen. Although in 2 ulcer cases there was no D L, Bonhoff believes that the test has a decided value and should be employed more frequently in doubtful cases. I may state here that this is the first article on this subject which has been published in a decade and serves to rescue the method from the depth of oblivion.

Oppler-Boas Bacilli. "As found in the stomach in cases of gastric cancer, the Oppler-Boas bacillus is a large, non-motile, non-sporing bacillus, with square ends, closely resembling the bacillus of anthrax, staining solidly with the usual anilin dyes; it is Gram positive. It is found singly and in filaments of four or more distinctly jointed members which frequently assume angles with each other, giving rise to a zigzag or geniculate appearance. Fresh specimens are highly refractile and when tested with Gram's iodin alone, are turned yellowish brown in color, a useful point in distinguishing the organism from the Leptothrix buccalis, which assumes a distinct bluish tinge. In culture the Oppler-Boas bacillus is found to resemble the B. bulgaricus so closely that the following description of the morphological and cultural characters applied equally well to both organisms, with this proviso, that the B. bulgaricus is, until educated by one or two subcultivations in milk, somewhat slower in coagulating this medium" (Galt and Iles[2]).

[1] Beitr. z. klin. Chir., 1914, xcii, 760.
[2] Journal of Pathology and Bacteriology, 1914, xix, 239.

The authors then prove beyond peradventure of a doubt, that there is an association between these bacilli and lactic acid in the gastric contents, and that the Oppler-Boas bacillus is identical with the B. bulgaricus and not an organism *sui generis.* They infer that in cases of cancer of the stomach it is the absence of hydrochloric acid that allows of the growth of the bacillus and that the lactic acid is formed as a result of the activity of this organism. From the work of Galt and Iles one must conclude that any condition giving rise to absence of free hydrochloric acid forms favors the growth of these so-called Oppler-Boas bacilli and that as far as their pathognomonicity in gastric carcinoma they have no value whatsoever.

Value of Laboratory Data in Gastric Cancer. Smithies[1] has again put his large experience in the Mayo clinic and elsewhere to good purpose, and discusses in the paper before us the diagnostic worth of laboratory examination in 700 cases, operatively and pathologically demonstrated to be cancer. He mentions particularly:

1. The information derived from the examination of gastric contents after test meals.

2. The information derived from stool analyses.

3. The facts shown by the examination of the blood.

4. Those learned by *x*-ray studies.

5. The significance of surgical pathologic reports.

1. Smithies' technic consists of giving to the patient at 4 P.M. on the day preceding the test meal, 61 c.c. of castor oil. At 6 P.M. he receives a moderate mixed meal. At 9 P.M. the patient is instructed to swallow twenty raw raisins, the skins as well as the pulp. If the history does not indicate retention, at 8 o'clock the following morning the patient is given an Ewald meal and the stomach is emptied at the end of fifty minutes.

In 72 per cent. of the cases there was a twelve-hour retention, in other words, nearly 3 out of every 4 cases showed some degree of impaired motility, irrespective of the location of the neoplasm in the stomach wall. As far as the acidity of the gastric contents is concerned, 54 per cent. showed no free hydrochloric acid. In nearly 46 per cent. the free acid ranged from a trace to as high as 120, while the total acidity ranged above 50 in about 20 per cent.

A word as to the acidity in the various types of gastric cancer.

Type of case.	No. of cases.	Average free HCl.	Average total acidity.	Average combined acidity.	Lactic acid.
Inoperable gastric cancer	436	7.46	28.3	21	62
Ulcerated primary cancer	65	2.0	34.0	31	63
Ulcers with malignant change	199	33.4	51.0	16	23

[1] Illinois Medical Journal, February, 1915.

Blood. In 72 per cent. occult blood was found, and it seemed to be a somewhat more frequent finding in those cases where ulcer had preceded than where such disease was clinically primary.

Glycyltryptophan Test. In 141 cases this was found to be positive in 40 per cent.

Wolff-Junghans Test. Two hundred and fifteen proved cases of cancer were examined. In 141, or 65.1 per cent., the test was positive; in 29, or 13.4 per cent., the test was suspicious. Combining the returns it is evident that 170, or 78.5 per cent., of the proved cases of gastric cancer were undoubtedly positive or suspiciously positive. In 45, or 21 per cent., of the cases it was negative. Smithies believes it is a more constant finding than absence of acidity, the presence of lactic acid, or positive glycyltryptophan test.

Formol Index. The average formaldehyde index of 57 cases of proved gastric cancer was 21; the average index of 40 cases of benign gastric ulcer was 10.8, and the average index in 75 cases of duodenal ulcer was 11.9. In 17 cases of achylia gastrica the average index was 14.1, of 10 cases of pernicious anemia it was 14.5, and in 5 cases of cancer of the liver it was 4.25.

Microscopic Examination of Test Meals. Oppler-Boas bacilli were found in 94 per cent. of the cases (158). When these bacilli are present, free hydrochloric acid is absent in more than 80 per cent. of the cases, and an abdominal mass or nodule may be detected in 3 out of 4 cases. This is a useful diagnostic observation for differentiation between retention due to cancer and that due to ulcer or extragastric tumor. (See Oppler-Boas Bacilli, preceding pages.)

2. *Stool Examination.* Occult blood was found in 78 per cent. of the cases on a meat-free diet.

3. *Blood.* The average hemoglobin was 72 per cent.; the average leukocyte count was 11,200. Digestion leukocytosis was frequently absent but not constantly so.

4. *X-ray Examinations.* Of 87 cases, 10 per cent. were diagnosed by the fluoroscope and plate. In more than 82 per cent. of the cases, malformation of the normal stomach outlines, with alteration in the peristaltic rhythm were shown. Frequently the x-ray examinations showed the location of physically inaccessible tumors. Early cases rarely showed anything typical.

5. *Surgical Pathology of Gastric Cancer.* Adenocarcinomata were demonstrated in more than 96 per cent.; colloid carcinomata ninety-five times, fibromata four times, and sarcoma once. In 27.4 per cent., ulcera carcinomatosa were demonstrated.

METABOLISM IN CARCINOMATOUS PATIENTS. In order to avoid the criticism which has been leveled at the work of former investigators, Wallersteiner[1] selected for subjects of his study only those who had no

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[1] Deutsch. Arch. f. klin. Med., 1914, cxvi, 145.

fever, no edema, and with no disturbance of the digestive apparatus interfering with the taking of food (vomiting, retention). His patients were those of pronounced cachectic habit and emaciated, exhibiting anemia and psychic depression. Patients who seemed to have but few days to live were not studied, as he found that such always had nitrogen retention, which naturally would interfere with a clear understanding of the problem.

Food was given in liquid form, and in this way a high caloric diet was administered. Calorimetry tests showed that the heat production of carcinomatous patients to be a very variable quantity, from 20 to 50 calories, but in a small percentage of the cases (about 10 per cent.) there seemed to be a decided increase of the total metabolism. These cases were those who for some reason or other did not or could not receive enough food to cover their metabolic body requirements, while those who received a diet sufficiently high, calorically speaking, showed approximately nitrogen equilibrium. Again, when food in excess of the body needs was taken, nitrogen retention was the rule, reminding one of the calorimeter experiments in fever states. In cases where no marked temperature changes could be noted, or where there was no "occult fever" (Aronsohn) and where there was nevertheless increased metabolic activity, Wallersteiner thinks it to be due to the toxic action of the tumor itself, which has to do not only with the nitrogen metabolism but with the total metabolism.

INOPERABLE CANCER TREATED WITH GOAT SERUM. Wilson,[1] recognizing the mystery of malignant diseases, raises the question why cancer should remain stationary in one patient, or even disappear spontaneously, and progress in others, and why should one species of animal be apparently immune to cancer, and why should inoculation of one animal of the same species with cancer give rise to tumor growth and the same not occur in another? It has been shown that while in health normal serum contains a substance which has the property of activating or accelerating the fat-splitting action of pancreatic juice, in certain cases of cancer this property is increased. In advanced cases this power of the serum is decreased, while the antitryptic action of the serum is said to be increased. During improvement, the accelerating fat-splitting action of the serum is high, while the antitryptic action falls to normal or is subnormal. In lower animals, this accelerating fat-splitting property of the serum is greater than in human beings, and in mice which have been inoculated with mouse tumor and did not "take" and also in those which had recovered spontaneously the accelerating fat-splitting action is high. It has been suggested in view of these facts that this fat-splitting acceleration is a factor in resistance to carcinoma, and hence serum and substances increasing this protective mechanism are indicated in treatment.

[1] British Medical Journal, 1915, i, 155.

Six cases are reported by Wilson, and each seemed to be somewhat benefited by the treatment. In one case 6 ounces of fresh goat serum were injected intravenously and in the other cases smaller amounts were employed, $3\frac{1}{2}$ ounces for the first injection, increasing the amount by $\frac{1}{4}$ ounce on every fourth day.

GASTRIC ANALYSIS. *Fallacies of the Ordinary Gastric Examinations.* Rehfuss[1] insists that a test meal removed at the end of forty-five to sixty minutes furnishes no evidence of gastric digestion, and he makes a plea for the fractional examination as detailed in the preceding pages of this monograph. He shows conclusively that normal figures at the end of an hour may be followed by high figures at the end of two hours, as may be gathered from the appended table.

TOTAL ACIDITY AND FREE ACID AT ONE- AND TWO-HOUR PERIODS

	Case 1			Case 2	
Time, hours.	Total acidity.	Free acid.	Time, hours.	Total acidity.	Free acid.
$\frac{1}{2}$	17.2	10.0	$\frac{1}{6}$	16.0	8.5
$\frac{1}{4}$	35.2	15.4	$\frac{1}{4}$	14.0	8.0
$\frac{1}{2}$	48.1	18.0	$\frac{1}{2}$	17.0	8.0
$\frac{3}{4}$	49.0	23.2	$\frac{3}{4}$	37.5	28.5
1	54.4	27.0	1	53.0	44.5
$1\frac{1}{4}$	66.0	33.0	$1\frac{1}{4}$	69.0	60.5
$1\frac{1}{2}$	106.0	45.3	$1\frac{1}{2}$	94.0	85.5
$1\frac{3}{4}$	104.5	48.3	$1\frac{3}{4}$	93.0	83.0
2	118.6	64.7	2	85.0	76.0
			$2\frac{1}{3}$	19.0	11.5
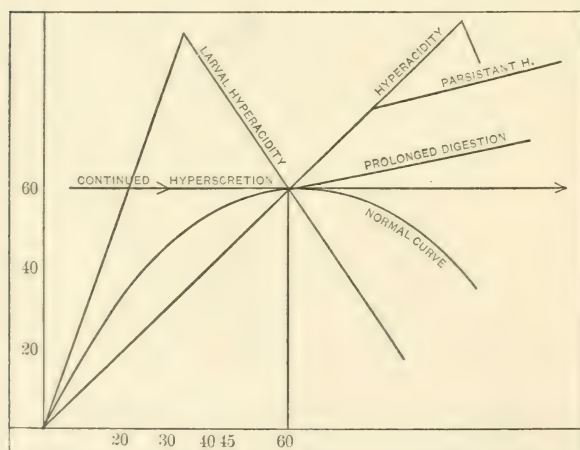
FIG. 17.—Possibilities in the interpretation of normal figures of the one-hour examination.

On the other hand, it is possible that there may be normal figures at the hour meals, but before that period there were hyperacid values.

[1] Journal of American Medical Association, 1915, lxiv, 569.

Again, normal figures at the one-hour point may be only part of a continued hypersecretion, therefore, figures which are obtained at the expiration of an hour have a varied significance and are of little value in themselves.

NORMAL TOTAL AND FREE ACIDITY AT ONE-HOUR POINT PRECEDED BY HYPERACIDITY

Time, hours.	Case 3 Total acidity.	Free acid.
$\frac{1}{12}$	6.7	Trace
$\frac{1}{4}$	19.8	7.5
$\frac{1}{2}$	25.3	14.0
$\frac{3}{4}$	75.7	53.3
1	43.7	24.0
$1\frac{1}{2}$	18.2	9.5
$1\frac{31}{4}$	24.5	11.5

One may encounter hyperacidity after forty-five to sixty minutes, whereas before this time normal figures would be seen, and there may be subnormal figures at the end of one hour but hyperacidity at the end of two hours.

NORMAL FIGURES AT THE ONE-HOUR POINT

Time, hours.[1]	Case 4 Total acidity.	Free acid.	Time, hours.	Case 5 Total acidity.	Free acid.
$\frac{1}{3}$	40.7	18.5	$\frac{1}{12}$	49.9	36.4
$\frac{1}{2}$	47.0	....	$\frac{1}{6}$	57.1	45.2
$\frac{3}{4}$	50.3	25.6	$\frac{1}{4}$	59.2	42.0
1	48.2	25.9	$\frac{1}{2}$	60.8	45.4
$1\frac{1}{4}$	43.5	25.0	$\frac{3}{4}$	58.2	44.0
$1\frac{1}{2}$	42.7	24.3	1	61.2	46.0
$1\frac{3}{4}$	44.9	25.7	$1\frac{1}{4}$	62.9	47.8
2[2]	48.4	28.5	$1\frac{1}{2}$	61.7	47.2
			$1\frac{3}{4}$	67.6	44.6
			2	68.4	49.6
			$2\frac{1}{2}$	68.0	48.6

HYPERACIDITY AT ONE HOUR

Time, hours.	Case 6 Total acidity.	Free acid.	Time, hours.	Case 7 Total acidity.	Free acid.
$\frac{1}{12}$	11.0	5.0	$\frac{1}{12}$	15.4	11.4
$\frac{1}{6}$	18.5	11.0	$\frac{1}{6}$	20.2	10.6
$\frac{1}{4}$	29.0	17.0	$\frac{1}{4}$	22.7	3.9
$\frac{1}{2}$	46.5	32.5	$\frac{1}{2}$	76.0	
$\frac{3}{4}$	83.0	67.0	$\frac{3}{4}$	110.2	37.7
1	93.5	80.0	1	118.2	34.1
$1\frac{1}{4}$	66.0	55.0	$1\frac{1}{4}$	101.2	44.0
$1\frac{1}{2}$	62.5	48.5	$1\frac{1}{2}$	90.6	42.4
$1\frac{3}{4}$	61.0	46.0	$1\frac{3}{4}$	121.9	32.9
2	48.0	35.0	2	110.0	

[1] Stomach empty—hypermotility.   [2] Marked hypersecretion throughout.

CASES REPRESENTING SUBACIDITY AT ONE HOUR AND HYPERACIDITY AT
TWO HOURS

	Case 8			Case 9	
Time, hours.	Total acidity.	Free acid.	Time, hours.	Total acidity.	Free acid.
$\frac{1}{6}$	4.5	Trace	$\frac{1}{12}$	31.8	
$\frac{1}{3}$	10.0	6.5	$\frac{1}{6}$	41.4	
$\frac{1}{2}$	12.5	8.0	$\frac{1}{2}$	30.2	18.0
$\frac{3}{4}$	21.0	14.5	$\frac{3}{4}$	30.2	20.3
1	34.5	....	1	38.8	23.3
$1\frac{1}{4}$	44.5	....	$1\frac{1}{4}$	38.0	26.7
$1\frac{1}{2}$	56.0	47.0	$1\frac{1}{2}$	43.5	30.0
$1\frac{3}{4}$	41.0	34.5	$1\frac{3}{4}$	43.0	30.3
2	36.5	....	2	50.5	38.0
			$2\frac{1}{4}$	56.3	44.5
			$2\frac{1}{2}$	63.3	52.7

Rehfuss, by his studies, makes a strong case for his fractional method,
and it would seem that to obtain a clear insight into the digestive curve
one should not be content with the extraction and examination of but
one specimen at the end of the hour interval. An objection may be
made to this method, that it imposes a long strain on the patient, and
on this account it may be impossible to carry it out in general office
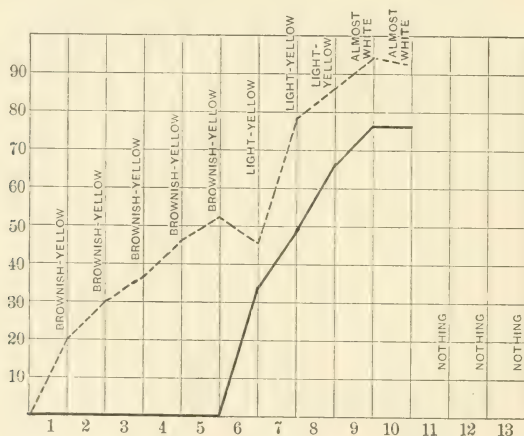
FIG. 18

work. This in no wise detracts from the value of the method, which
seems to promise to furnish much important information.

Skaller[2] has undertaken a similar study, with almost identical results
as Rehfuss obtained. Skaller also insists that the one examination of

[1] The end of this curve was followed by pronounced hypersecretion, which was
very persistent and gave on an average of several samples taken: total acidity, 76.3;
free acid, 69.8.

[2] Berl. klin. Woch., 1915, p. 105.

a portion of gastric contents is most fallacious. The one curve which I shall reproduce from his article illustrates a condition found by Rehfuss, namely, marked hyperchlorhydria, after a period of "normal" acidity, in an individual with absolutely no gastric symptoms.

Testing the Gastric Contents without Using the Stomach Tube. Schütz[1] reviews at some length the methods devised to avoid the swallowing of a stomach tube, and emphasizes the fact that no method can replace the tube. Of other means at our disposal, the tests for occult blood and the *x*-ray examination are the most reliable. Tests advocated for detecting the presence of hydrochloric acid without the stomach tube are utterly useless.

Blotting-paper Method for Estimating Gastric Acidity. The principle of Sochanski's[2] method is capillary attraction. If one dips a piece of blotting-paper in a solution of mineral acid, it will be found that the acid is absorbed more quickly than the water. If a drop of hydrochloric acid is let fall on a piece of blotting-paper, there appears a round spot comprised of two concentric circles, of which the acid is the inner and the water the outer. If one wishes to estimate the percentage of acid in the solution, the following formula may be used.

$$ P = \frac{r^2}{R^2 - r^2} $$

in which r is the diameter of the inner, and R the radius of the outer circle. Since blotting-papers absorb differently with acid solutions, by using various strength solutions, one eventually is able to obtain a solution in which $r = R$. This concentration is then constant for that particular filter paper (R) and is to be multiplied by

$$ \frac{r^2}{R_2 - r^2} $$

in order to obtain the percentage of the acid in the solution.

If one now takes a piece of blotting-paper, on which are stamped points at distances of 1 mm. from one another, and impregnates it with a watery solution of congo red, and allows a drop of hydrochloric acid or gastric juice to fall on it, the marks or points within the inner circle will become blue, while the outer ones remain red. If the spot has ceased to enlarge, the paper is held against the light, r and R are measured, and the amount of acid determined. To express the acidity in terms generally used for hydrochloric acid, the coefficient R is substituted by K, which is obtained by multiplying K by $\frac{100000}{365}$.

Sochanski claims the method to be inferior to the usual titration methods, but holds that it is more convenient for use in office work. I

[1] Arch. f. Verdkr., 1914, xx, 304.   [2] Ibid., 317.

must confess that personally his method seems very much involved and but incompletely detailed, so that most of us would have difficulty I fear, in analyzing gastric contents by its use.

Water Test Meal. Based on the knowledge that water is able to stimulate the production of as much gastric juice as follows the administration of an ordinary Ewald meal, Austin[1] has given to a series of patients, 350 c.c. water, removing the contents at the expiration of twenty minutes. The average acidities after the meal are found to be lower than after an Ewald meal (20 and 30) which Austin ascribes to the insufficient stimulus of the water. He believes, nevertheless, that the water meal serves all the needs of a clinic for establishing secretory and motile powers of the stomach.

GASTRIC MOTILITY. *Chlorophyl Test for Gastric Motility.* Technic. The patient on a fasting stomach drinks 400 c.c. of water which has been colored pale green by the addition of 20 drops of a watery chlorophyll solution. At the end of half an hour, the residue is aspirated with the stomach tube and the amount noted. In order to make the test more accurate and that no residue might escape, the stomach is then washed out with a 1 per cent. watery solution of sodium bicarbonate. The amount of this solution used for lavage depends upon the amount of residue aspirated at the end of one-half hour. Let the thirty-minute residue equal X. The stomach is washed out with 400 c.c. minus X c.c. The residue and the wash water are put together and made up to 400 c.c. (if necessary), and the green color of the mixture is compared with dilutions of the original chlorophyl water taken (400 c.c. water and 20 drops chlorophyl solution) and in this way the percentage of the colored water, which has passed out of the stomach in a half hour is estimated.

This test was devised by Boas and is based on the observation that 500 c.c. of water leaves the normal stomach in one-half to three-quarters of an hour, and on Boas' own observation in normal cases, that 400 c.c. of water taken into the fasting stomach, leaves a residue of 50 to 60 c.c. in one-half hour.

The chlorophyl solution is tasteless, easily obtained and is not absorbed from the stomach. It is, however, easily precipitated by saliva and mucus and the patient is warned not to swallow saliva after drinking the chlorophyl water.

White[2] has made use of this test, and has decided that the second lavage with sodium bicarbonate is useless, as the chlorophyl solution clings to the mucus in the stomach and makes the second part of the test inaccurate. In a series of 50 cases the test was compared with the Leube seven-hour test. In 90 per cent. of cases, the results are the same

[1] Boston Medical and Surgical Journal, 1915, clxxii, 857.
[2] Ibid., November 19, 1914.

as with the Leube meal, and in the remaining 10 per cent. the differences are all minor ones. No important change in motility was missed and in this way the test was satisfactory for diagnosis. White approves of the test on account of its simplicity, and on account of the fact that the sources of error are few and unimportant. It is probably not superior in accuracy to the older tests, but is an added method applicable with ease to all cases.

Organic and Functional Achylia Gastrica. Disqué.[1] In organic achylia we have to do with an atrophy of the gastric mucosa, of more or less severe degree, occurring as a result of chronic gastritis or as an accompaniment or gastric carcinoma. It may develop from hyperacid gastritis, and may result from anacid gastritis, or it may be seen in cases with an intact mucosa, anatomically speaking, but inefficient functionally. Organic achylia is seen frequently in elderly individuals with arteriosclerotic atrophy of the mucosa, or in kidney, liver, heart, and pulmonary disease.

The functional form of achylia gastrica is more common than the organic. The cause is generally to be sought in the nervous system. Some authors claim that there is no such condition as functional achylia, but that all forms of achylia have an anatomic basis, this being atrophy of the gastric mucosa. Disqué thinks that a functional achylia may be congenital as well as acquired. Individuals of the congenital form are generally constitutionally weak, with long, narrow thorax and a " *Tropfenherz*." As causes of the acquired form Disqué cites changes in the blood or nervous system, physical exhaustion, anemia, tuberculosis, neurasthenia.

The *diagnosis* of achylia is based on three cardinal symptoms, namely: (1) Absence or but slight amounts of mucus in the gastric contents, diminution of hydrochloric acid secretion, and of pepsin and rennin. Usually the total acidity is under 20 and there is a hydrochloric acid deficit. (2) Interference with the mush-like chymification of the gastric contents. (3) Increase of the emptying power of the stomach.

The gastric contents after an Ewald meal must not be fluid or semiliquid or else the condition is not achylia. Instead, the contents are thick, scarcely wet or digested.

Subjectively there may be no symptoms; when present, they consist of pressure, fulness and pain in the gastric region, accompanied by belching, vomiting and all manner of gastro-intestinal symptoms. As a rule, there is a diarrheal condition (gastrogenous), which pulls the patient down in a comparatively short time. The stool examination of such patients reveals disturbance of digestion of connective tissue, meat fat, and carbohydrates. The intestinal flora changes materially, and this is to be referred to the absence of hydrochloric acid which

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[1] Arch. f. Verdkr., 1914, xx, 366.

permits of the development of bacteria which are usually destroyed by the disinfecting properties of the normal gastric juice.

The differential diagnosis between achylia and chronic gastritis is not easy, according to Disqué. In gastritis there is more mucus and the gastric contents are more fluid, and there is more variation of the hydrochloric acid and of the ferments. The motility of the stomach is not so active and, indeed, there is a retention. Microscopically the gastric contents in gastritis contain leukocytes, mucus, and epithelial cells. As aids in distinguishing between cancer and achylia are tumor, emaciation, positive Salomon test, lactic acid, occult blood, x-ray, etc. These are the aids relied upon by Disqué, but they are later signs and not of much use. The Salomon test I contend is unreliable.

Between organic and functional achylia the diagnosis is very difficult. There seems to be nothing to be considered as important in each instance. When many leukocytes are recovered in the gastric contents, particularly eosinophile cells, it indicates achylia of organic nature. Sometimes bright red blood is seen, and although this is observed more frequently in organic achylia, it has been discovered in the functional form also.

The gastric chemistry offers very little of differential diagnostic worth. Prognostically, functional achylia is more favorable than the organic.

Diastase in Achylia Gastrica. Brown[1] found the diastase content of the stools to be normal in all of the cases he examined. This suggests that in the absence of hydrochloric acid some other means of activation is called into play and the diarrhea met with in certain cases of achylia gastrica, and gastrogenous diarrhea is not of pancreatic origin.

Hour-glass Stomach. An hour-glass stomach is easy of recognition by means of the x-ray, the difficult feature of the problem being to distinguish between spastic and organic contractions, malignant and non-malignant contraction.

Differentiation between Organic and Spastic Hour-glass Stomach. The use of atropin or papaverin is unreliable and the only sure means is to have repeated examinations made from day to day. It is perfectly true that a persistent contraction can exist in the absence of ulcer. If there is, however, an associated motor insufficiency, the stenosis is probably organic. The shape of the stomach is said to have importance; thus the tube-shaped or X-shape of the hour-glass indicates organic contraction, while the spastic constriction resembles more or less the letter B. The syndrome of (a) approximation of the pylorus to the cardia (b) motor insufficiency (c) hour-glass stomach, speaks for an organic basis for the contraction, generally in the nature of adhesion. The cause of the delayed motility may not be always pyloric obstruction *in sensu vera*, but may be due to a "perigastritis deformans," which causes changes in the stomach so that its emptying function is interfered with.

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[1] Bulletin of Johns Hopkins Hospital, July, 1914.

DIFFERENTIATION BETWEEN CARCINOMATOUS AND NON-CARCINOMATOUS HOUR-GLASS STOMACH. It is true that in the former the channel between the bulges of the hour-glass stomach is long in carcinoma, while in the benign contraction it is shorter and saw-edged in character. Although true, this dictum is incorrect in certain cases, and the result is that in some individuals the differentiation can not be made by the *x*-ray alone, but must be determined by taking into consideration the general symptomatology.

PENETRATING ULCER AND HOUR-GLASS STOMACH. In a great majority of cases the two conditions are associated, and no suspicion of the contraction is entertained before the *x*-ray examination reveals the true state of affairs (Strauss[1]).

Thaysen[2] says that repeated röntgenoscopy will reveal the fact that spasmodic contraction of the stomach is responsible for disturbances far more often than generally credited. The apparent stenosis or contraction will be then seen to subside and return, instead of the persisting condition otherwise assumed when but a single examination is made. Treatment is the same as for gastric ulcer; if not very pronounced the spasm will cease as the ulcer heals, but, with persisting hour-glass contraction of organic origin, nothing but surgical measures will bring relief. This can be insisted on with greater emphasis as ulceration is almost inevitable in an hour-glass stomach sooner or later.

Acute Dilatation of the Stomach.[3] The symptoms of this condition begin abruptly with persistent vomiting of a biliary or dark stained material which is never fecal in nature; the pulse becomes small, soft and rapid, the respirations are rapid and superficial; the temperature is subnormal, there is no evacuation of urine or stool, but there is great distress to the patient on account of the excessive thirst and abdominal distention. When such cases are autopsied an enormous dilatation of the stomach is seen, and also the contiguous duodenum is greatly distended. This finding has led many others to regard the condition as one of arterio-mesenterial ileus, and others to consider it as being due to duodenal compression by the mesentery of the small intestine, which is followed in turn by the gastric dilatation. Linke[3] is of the opinion, from his reading and own experience, that, unless the musculature of the stomach has been weakened in some way, duodenal compression alone can never cause acute gastric dilatation.

The causes of the weakened gastric musculature are many, if one may judge of the opinions expressed by various authors. Riedel believes there is a serious infiltration of the muscle fibers of the stomach. Walzberg, that there is a hyperemia of the mucosa due to handling at the time of operation, and Theilhaber thinks both play a role, the

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[1] Arch. f. Verdkr., 1915, xxi, 89.
[2] Abstract, Journal of American Medical Association, 1914, lxiii, 72.
[3] Beitr. z. klin. Chir., 1914, xciii, 360.

infiltration and the hyperemia. Körte holds to a mechanical factor, that of much traction at operation, while toxic or infectious degeneration is the causal factor according to Albu, Boas, Fränkel, and others. Local peritonitis is advanced as another cause by Kelling and Binswanger. Linke attempts to summarize the various views into one, namely, that acute dilatation of the stomach is an expression of paralysis of that organ, the paralysis due to central or peripheral nerve changes to mechanical and toxic factors, and perhaps to changes in internal secretions.

The most important therapeutic measure is laying the patient on his abdomen, a procedure suggested by Schnitzler, who believes that compression of the duodenum could take place only with the patient on his back, and who argued that the abdominal position would tend to relax any constriction. The knee-chest position (?) has been recommended as also the right-sided posture. Whoever has seen a patient with acute dilatation of the stomach must stand aghast at the advisibility of having the patient assume a knee-chest position. In the cases I have seen, immediate relief has followed profuse and thorough gastric lavage followed by a right-sided position and hypodermic injections of eserin. *Bene curat qui bene diagnoscit* holds here with particular force as a tardy diagnosis makes successful treatment a matter of great difficulty.

Last year[1] I quoted a remarkable observation of Richardson of acute dilatation of the stomach occurring during an operation. This experience has a duplicate in that of Mayoral[2] who witnessed a similar case during an operation for double pyosalpinx. The stomach dilated until it reached within a short distance of the symphysis pubis, and only the prompt use of the stomach tube saved the patient's life. Mayoral believes the cause lies in paralysis of the stomach centre of the brain, due to the anesthesia which had to be pushed to the limit, and secondary to this the accumulation of gases within the organ. He denies the factors of duodenal constriction, excessive secretion of analysis from overdistention, and peritonitis, the three common causes of acute dilatations.

Why is it in medical experience that the report of a certain kind of case is followed by others of similar character? I have in mind this acute dilatation of the stomach occurring under one's very eyes during operation. Mayoral's case report is now followed by the report by Luckett[3] of his cases. Is it possible that heretofore surgeons have overlooked such a serious complication, or has acute dilatation until now not occurred during operation? And if not, why is it that suddenly, within a year, four cases are brought to our attention?

[1] Progressive Medicine, December, 1914, p. 54.
[2] Journal of American Medical Association, 1915, lxiv, 146.
[3] Ibid., 2055.

Syphilis of the Stomach. Downes and Le Wald[1] consider that the symptoms of gastric lues differ very little from other lesions of the stomach of equal extent and like location, but they believe when carefully analyzed, there are certain striking differences to be noted. The pain is different from that of ulcer, lacking the periodicity of the latter and being influenced but little by the taking of food. It is, however, persistent in character. Vomiting is an early symptom, but hemorrhage has not been so frequent or so severe as in simple ulcer, a fact that helps to differentiate syphilis from simple ulcer and a predominating feature is extreme loss of weight.

In the congenital cases, the family history and the early history of the patient, the general development with syphilitic stigmata and symptoms of gastric disturbance are most suggestive, and in the acquired cases a history of infection is important. Unlike ulcer, it is influenced but little by the ordinary methods of treatment, and, unlike malignancy, it has not the steady and continuous progress to a fatal determination. A positive Wassermann in such cases, and the *x*-ray findings of gastric deformity make the diagnosis practically certain. The authors also believe that the therapeutic test is of great value, and although mixed treatment and salvarsan sometimes bring about improvement in ulcers and even in cancer cases, the benefit is of short duration, whereas in syphilis the improvement is prompt and lasting. Pathologically, the diagnosis is more difficult than clinically, owing to the resemblance to tuberculosis.

The Röntgen-ray findings are divided into three classes: (1) A diminished size of the stomach and a dumb-bell-like appearance due to infiltration of the middle or pyloric half of the stomach. The pyloric sphincter may be held open and bismuth is seen to leave the stomach more rapidly than normally, although there may be some remains at the end of the sixth hour. (2) The findings may be similar to that in class one, except that there may be involvement of the pylorus to such a degree that there is obstruction, such as occurs in ulcer or in cases of cancer. In both the first and second classes of cases, the stomach is smaller than normal and there seems to be a compensatory dilatation of the esophagus. (3) In this type of case there may be infiltration of only the pyloric region, in which event dilatation of the stomach is seen, and the findings closely resemble those observed in cicatricial ulcer of the pylorus.

If the diagnosis is made early, medical treatment is *de rigeur*, if not, surgical interference may become necessary to relieve complications.

Neugebauer[2] calls attention to the frequent occurrence of hyperacidity and achylia in gastric syphilis, and contends that hyperacidity

[1] Journal of American Medical Association, 1915, lxiv, 1824.
[2] Wien. klin. Woch., 1914, p. 845.

is a rarity. This he says is due to change in the vagus tonus and to a direct disease of the stomach wall (luetic gastritis).
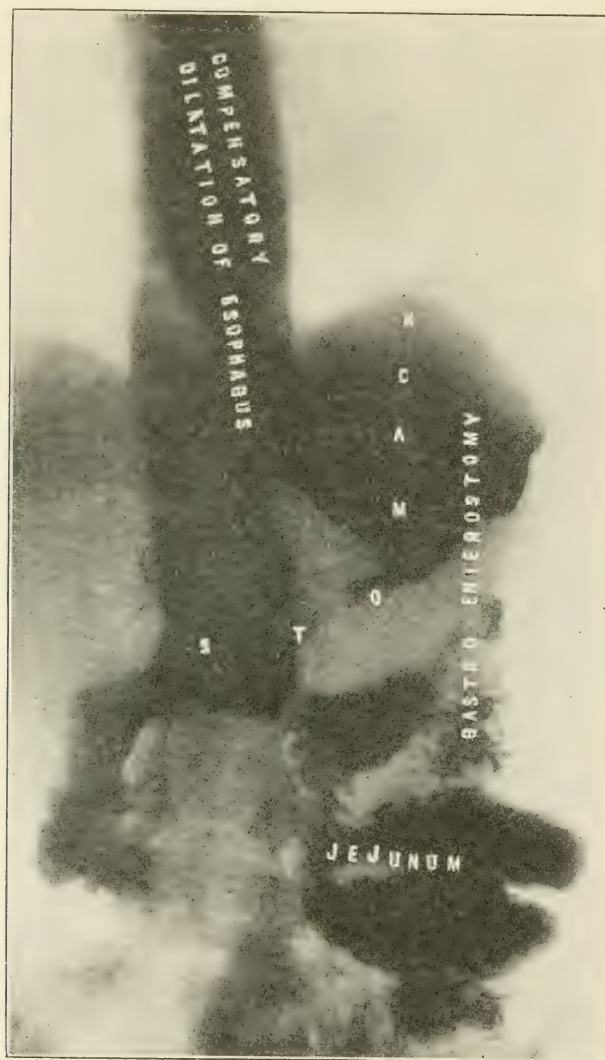
Fig. 19.—Girl, aged fourteen years. Note dumb-bell-like appearance due to sclerosis of body of stomach. After gastro-enterostomy, most of food going through opening, but enough passing through stenosed portion to outline it. Note compensatory dilatation of esophagus.

Einhorn[1] reports more cases of gastric syphilis, and although recognizing the importance of making a correct diagnosis, and of not

[1] Medical Record, 1915, lxxxvii, 421.

mistaking the condition for carcinoma, he gives us very little on which a diagnosis can be made. All signs may point to a malignant neoplasm, clinical, laboratory, and x-ray, but one should not forget the possibility

FIG. 20.—Woman, aged thirty-four years. Note hour-glass constriction with long channel between pouches. Condition confirmed at operation and relieved by breaking up of perigastric adhesions and performance of gastro-enterostomy to the lower pouch.

of gumma in making a diagnosis of cancer. A positive Wassermann is of doubtful value and its presence does not indicate that the gastric affection is syphilitic, nor does its absence positively deny syphilis.

Einhorn recommends antisyphilitic treatment for from two to four weeks or more. If there is general improvement all is well; if not, inasmuch as syphilis is so rare, is it well to delay an exploratory laparotomy on the chance of a given case being syphilitic? Are we thereby obstructing the "early diagnosis" and early treatment of carcinoma.
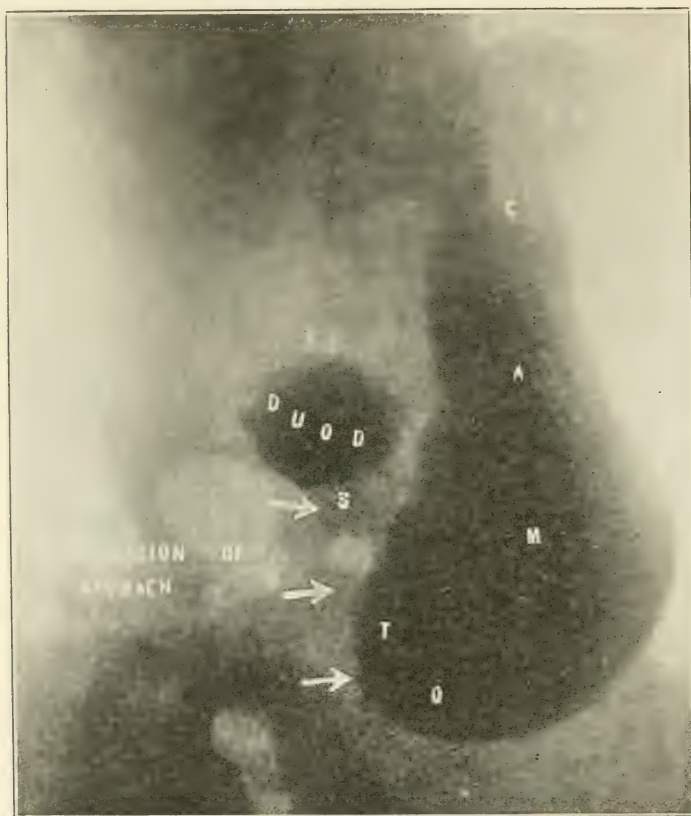
Fig. 21.—Woman, aged twenty-three years. Note deformity at pyloric third of stomach due to sclerosis. Note close resemblance to new growth. Diagnosis of syphilis confirmed by operation and microscopic examination of section of stomach wall. Symptoms relieved by gastro-enterostomy, but deformity persisted.

Chronic Inflammation of the Omentum as a Cause of Stomach Trouble. Ekehorn[1] reports two cases and cites one published by Destot in which chronic inflammation of the omentum caused pain in the gastric region, independent of meals, with vomiting after eating. The pains and cramps lasted about a half hour at a time and returned several times a day or with free intervals of a few days. These disturbances had

[1] Abstract, Journal of American Medical Association, 1915, lxiv, 1804.

dragged through several years in one case. In the second case the onset was more stormy, and the troubles were more serious and persistent. Immediately after eating there were stabbing pains, even after drinking a small glass of milk. In both cases there was a tender area above the umbilicus, but röntgenoscopy was negative, and nothing was found to suggest an ulcer. In both, the omentum showed signs of chronic inflammation, and both were entirely cured by resection of the omentum.
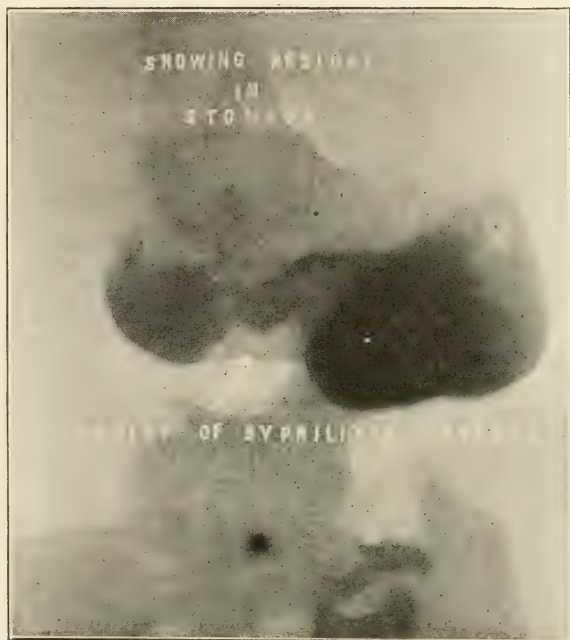
Fig. 22.—Boy, aged sixteen years. Note deformity at junction of pyloric and middle thirds of stomach. This case responded to medical treatment, but the deformity remained.

Indigestion. An analysis of one thousand private patients seen by Van der Hoof[1] has been productive of interesting results. The series is made up of only those patients whose chief complaint was some digestive disturbance, as "stomach trouble," dyspepsia, abdominal pain or distress, flatulence, vomiting, etc. It was found that appendicitis and cholecystitis are responsible for approximately 30 per cent. of the cases of chronic indigestion; peptic ulcer and neuroses, each 10 per cent., and carcinoma 5 per cent. Ten per cent. are cases of chronic gastritic, visceroptosis, adhesions, etc., and 25 per cent. comprise cases

[1] Johns Hopkins Hospital Bulletin, 1915, xvi, 151.

in which the digestive disturbances were reflex, other organs not properly included among the digestive organs.

	Per cent.
Appendicitis and cholecystitis	35
Peptic ulcer	10
Neuroses	10
Cancer (stomach and intestines)	5
Chronic gastritis, visceroptosis, peritoneal adhesion, enterospasm and enterogenous toxemia	10
Affections of kidneys, lungs, heart, eyes, blood and ductless glands, ears, central nervous system, female pelvic organs, migraine and chronic infectious diseases	25
Miscellaneous conditions	5
Total	100

The miscellaneous conditions include pellagra, amebic dysentery, malaria, diseased tonsils and cyclic vomiting, intestinal parasites, etc.

Of the patients suffering with appendicitis and cholecystitis, and who consented to operation, 61 per cent. were cured by operation, 28 per cent. were much improved, and 11 per cent. were not improved.

FATIGUE DYSPEPSIA. Guthrie Rankin[1] offers an apology for intruding into the mass of literature on digestion a new element, but thinks the question of "fatigue dyspepsia," as he calls this variety of dyspepsia, is vital enough to warrant its introduction into medical literature. The usual forms of dyspepsia which declare themselves by discomforts directly related to the ingestion of food are known as "acid," "atonic," or "fermentative," according to their prevailing symptoms, and the causes upon which these varieties of dyspepsia depend are many. In "fatigue dyspepsia" there is one additional cause met with in every case, namely, an irritable or exhausted state of the nervous system, the result of overstrain. Its victims are those whose work makes excessive demands upon the central nervous system, rather than upon the physical organism, and comprise those individuals whose labors are intellectual or originative rather than those who earn their bread by the sweat of their brow. Another class of men affected are those whose affluent means preclude any necessity for active effort, but who are distinctly "worriers." In their case the nervous system becomes exhausted from passive toxemic influences, but in both classes of individuals there is engendered a neurasthenic state, which becomes concentrated on the processes of digestion, and a vicious circle is eventually established.

Every case of fatigue dyspepsia is accompanied by the same underlying phenomena of neurasthenia, loss of weight, dream disturbed, or broken sleep, capricious appetite, a constant sense of physic fatigue,

[1] British Medical Journal, 1915, i, 1033.

failing powers of mental concentration, loss of memory, irritability, introspective uncertainty, depression of spirits, restlessness, and a firmly established conviction that the world is "out of joint." The leading features of the dyspeptic element may be summarized as follows:

"The appetite is not necessarily seriously impaired, but the patient becomes suspicious of one thing after another in his daily dietary, and cuts it out of his menu in the hope thereby of finding relief to the miserable discomfort he comes to realize will inevitably succeed every meal. This discomfort is not experienced immediately, but declares itself from two to four hours after food by a gnawing and burning sensation in the epigastrium, gradually succeeded by a feeling of oppressive distention, with a commanding desire to find relief in constantly repeated eructations, or even actual vomiting. These efforts are at first accompanied by an excessive flow of saliva, gradually replaced by acid and acrid regurgitations of fluid from the stomach. The sufferer soon comes to know that temporary relief is obtained from sodium bicarbonate or soda mint lozenges, and, further, discovers in time that the taking of more food gives him immediate, though temporary, immunity from his trouble. He is often aroused from sleep in the early hours of the morning with all the symptoms referable to his stomach in full activity, and so familiar does he become with the relief afforded by food of any kind that he adopts the plan of having biscuits by his bedside, in order to secure such comfort as will enable him to go to sleep again. Sickness is unusual except in advanced cases where dilatation of the stomach has taken place, but relief is sometimes sought by a voluntary emesis. As a rule, the bowels are obstinately confined, but they may be irregular in their action, with a liability to diarrheal evacuations from time to time. This is specially apt to happen when there are colonic complications. The subjective sensation of pain is accompanied by tenderness over the stomach region, and this may be so acute as to make even the pressure of clothing uncomfortable. The ultimate effect on the general nutrition is not so marked as might be expected, and when assimilation fails, as it does eventually, the emaciation would seem to be due much more to a progressive general neurasthenia than to inanition from loss of food. Though the patient fears his food because of the subsequent discomfort, he takes it well until he reaches the stage when he tries experimentally to cure himself by abstaining from one article of dietary after another because he believes this, that, or the other to be responsible for the pain. Sooner or later the participation of his nervous system in the disturbance of his health becomes such a predominating feature of his condition that the digestive phenomena, though the pivot round which all the other symptoms fluctuate, come to occupy a subsidiary place. The patient is now mentally wretched, and so obsessed with the increasing evidence of failing health, that he gets driven from all successful participation in the duties and

circumstances of his every-day life. All else is subordinated to anxiety about his health, and his fears of cancer or some other equally serious explanation of his symptoms are fed by the constantly recurring pain in his epigastrium, with its accompanying sense of overdistention and concurrent waterbrash or heartburn. The acidity is often so distressing as to lead to an excessive and unwise use of strong solutions of sodium bicarbonate or other alkali.

"When a patient suffering from such a series of subjective symptoms is examined physically, he presents all the phenomena already referred to as indicative of the neurasthenic state. In uncomplicated cases there are no evidences of disease outside the alimentary tract, but when this comes under investigation it will be found invariably that a definite group of signs accompanies the subjective symptoms which have fixed themselves upon the patient's attention. There is a well-marked localized tenderness on pressure over the right region of the epigastrium, intensified by causing the patient to take a deep inspiration, and accompanied by rigidity of the upper segment of the right rectus muscle. The stomach is flabby, or even in severe cases dilated, and splashing sounds can often be elicited on succussion. In many cases the colon is distended and sometimes fecal accumulations can be discovered, especially in the ileocecal region or along the course of the sigmoid flexure. Collateral physical signs are frequent, and some of the more prominent are worthy of mention. Thus, in patients who are thin, the right, or more rarely, the left, kidney is palpable, and may be abnormally loose. The urine frequently contains phosphates in excess, and in a fair proportion of cases the presence of indican can be demonstrated. The skin is inelastic and greasy; the complexion is muddy, and may be eloquently expressive of a toxemic state of the blood. The teeth are often found to have been inadequately cared for, and the gums may show signs of a more or less pronounced pyorrhea. Evidences of a vasomotor instability are prominent and manifest themselves in cold and clammy hands and feet, waves of heat or cold radiating over the whole body, chilly perspirations, periodic attacks of polyuria, vertiginious sensations on sudden movement or change of position, and unexpected diarrhea with offensive stools interrupting a chronic condition of obstinate constipation."

The treatment is dietetic, therapeutic, and disciplinary. In the matter of diet, the main indications are: avoidance of sugar, tea, sweet or effervescent wines, uncooked fruits or vegetables, and limitation of starches, red meats, and accessories.

The therapeutic indications are to combat hyperacidity, fermentative tendencies, and "tonics." Rankin gives numerous prescriptions which it seems unnecessary to transcribe.

The disciplinary measures are hot baths every morning, exercise, regulation of the day's work, with avoidance of mental effort after the evening meal, eight hours rest in bed, and many holidays.

One is forced to wonder after reading the above whether "fatigue dyspepsia" is a good term, or whether the condition described by Rankin is not after all the same as that made familiar by Lane's work.

Gastric Neuroses. Owing to my inability to read Calligaris' article in the original, I rely on the very complete abstract of the same which appeared in the *Journal of the American Medical Association*, 1915, lxiv, p. 1882.

Calligaris thinks that clinicians are apt to regard the majority of stomach affections too exclusively as symptomatic, while the neurologists regard them exclusively as purely functional and of psychic origin. The treatment of these two extremes is exactly opposite, and woe betide the nervous dyspeptic who falls into the hands of a clinician who disregards the nervous element, or *vice versa*, the patient with organic trouble whose precious time is wasted on psychotherapy alone. Calligaris classifies gastric neuroses under two types: the false, symptomatic or secondary, and the true, the essential or primary neurosis of the stomach. The history of this latter type is scarcely fifty years old. The symptomatology is rich indeed. The kaleidoscopic picture is the chief point in differentiation. Generally there are both sensory and motor symptoms. Vomiting may occur in this type but the possibility of hematemesis of purely nervous origin is generally denied. Calligaris is convinced that this denial should not be too absolute, but he does not believe in the possibility of an exclusively gastric neurasthenia.

The examination of the stomach should be done with extreme caution and tact to refrain from suggestion that may add new features to the clinical picture. Organic trouble should be suggested more readily if the patient is near or past fifty. A purely functional stomach trouble may lead to an organic affection, thus setting up a grave vicious circle. There is no doubt that certain patients with true gastric neuroses have recovered under courses of dieting and medicines, but there is also no question of doubt that hosts of others have had their gastric neurosis bred into a chronic and possibly an incurable phase by such measures.

He has had opportunity to study fifty individuals with true gastric neuroses. It was easy to trace the relation between cause and effect, between emotions, phobias, autosuggestion and suggestion from others, and the development of the neuroses, to follow day by day and hour by hour the course of the symptoms from the stomach as they paralleled the fluctuations in the moods and the emotions, and to note the regular transient aggravation of the neurosis after certain happenings and the rapid and progressive improvement under psychotherapy. Disturbances in secretion, motor functioning, and sensation, in patients growing more and more debilitated, disappeared surprisingly fast under appropriate psychotherapy, and the downward trend toward mental anorexia was thus arrested. Some of these patients had long complained of loss of

appetite with inability to eat, and had lost from 20 to 33 pounds, but under eight to ten weeks of isolation and psychotherapy, they regained strength and almost their former weight. The outcome confirmed the correctness of the diagnosis and treatment; if treatment had been on the basis of an assumed organic trouble, the old disturbances would have been kept alight or fanned into a flame. It is in these cases that "local treatment kills; general treatment saves." Both Dubois and Dejerine believe that fully four-fifths of digestive disturbances are of purely nervous origin. Even reducing this figure by one-half, leaves a large number, of which this is certainly true. They owe their origin to some emotional stress or to suggestion from within or without, and mostly from some suggestion from some medical treatment which fixes the gastric neurosis still more firmly in the patient's mind, by the questions asked, repeated examinations, restrictions in the diet, and polypharmacy. "There are stomachs for the chemists and the radiologists and also for the physiologists, the psychiatrists, and the neurologists." He adds, "Nature presents her phenomena with a thousand aspects, but man is liable to see only the one aspect which his eyes have been specially trained to see."

Sialophagia. Hayem[1] makes a distinction between swallowing of air alone (aërophagia) and swallowing of saliva mixed with air (sialophagia), and claims that the latter is a matter of great frequency. It may be readily recognized by listening over the fundus of the stomach when the patient swallows. A sound which Hayem calls "borborygmes esophagostomacal" is heard in from two to four seconds after the first effort at deglutition. When this sound is detected the possessor thereof is to be classed as a gastropath no matter what may be the value of his complaint or of his condition.

Gastric Headaches. Cheney[2] calls attention to headaches due to gastric disturbance. The headaches are usually periodic and repeat themselves throughout months and years. They may occur but once a month, or several times in a week. They may be constant over certain periods, during which time the headaches may be never entirely absent, though mitigation of severity is seen at times. The commonest history is that of sudden, unexpected attacks of headache coming on after a period of good health. The patient awakens with pain in the morning, which pain becomes more intense as the day goes on; or it may come on in the evening, persist during the night, pass off when the patient gets up. The headaches may be so severe that the patient is incapacitated from work. Sometimes nausea and vomiting (sick headache) are associated, but there may be no disturbance of the gastric intestinal tract to call attention to this system. The common

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[1] Annales de Méd., July, 1914, p. 1.
[2] American Journal of Medical Sciences, 1915, cxlix, 656.

type of headache is hemicrania, though not always on the same side. The pain is described as boring in character, through the eye or temple, or it may be the entire half of the head, even back to the base of the nape of the neck, that aches and throbs, while the opposite side is entirely free of discomfort and as clear as ever.

The correct diagnosis rests on a gastric analysis. The most frequent disturbance is one of motility, but hyperchlorhydria is very frequent also. In the latter instance, the taking of highly seasoned food proves disastrous, and headaches are apt to follow this indiscretion in diet. Low-grade chronic gastritis is a third form of gastric disturbance.

Cheney cites some cases illustrating the various types of gastric inefficiency, and demonstrates cure of headache of this type by regulating diet and medication. I should have liked to have had some mention made of the blood-pressure in these cases. Some of the case histories remind me very forcibly of certain cases of hypotension reported by me in the *American Journal of Medical Sciences*, 1914, cxlvii, p. 503, the more so as the treatment advocated by Cheney includes more physical exercise, which of necessity brings with it shortened hours of work and lessening of mental and nervous strain. It is presumed that blood-pressure readings were made and were found to be normal, otherwise the author would have specifically mentioned the fact.

Vomiting and Blood-pressure. "The object of the present research was to study the blood-pressure, preceding, during, and following the act of vomiting, and to ascertain so far as possible the mechanism of the changes in the blood-pressure or the regulation and control of the blood-pressure at such a time" (Brooks and Luckhardt[1]). The writers suggest that there are different types of vomiting induced experimentally, the variations depending principally on the character of the drug used, on the composition of the gastric contents and on the degree of participation of the skeletal musculature or of the diaphragm or the gastro-intestinal musculature respectively. They have recognized two general types of vomiting. First there is a sudden, rapid, projectile type, which comes on with but few premonitory symptoms, and exhibiting a preponderance of the gastro-intestinal musculature over the skeletal muscular system. The second type is slow and labored, with prolonged premonitory symptoms, and with participation of the skeletal musculature rather than of the gastro-intestinal.

In the first type there is a sharp fall of blood-pressure, during which there is slowing or almost cessation of the heart beat, or arrhythmia. The vomitus is expelled near the low point of the blood-pressure curve, and immediately after there is a return of the pressure to normal or even above.

In the second type, there are great oscillations of blood-pressure,

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[1] American Journal of Physiology, 1915, xxxvi, 104.

with irregular or slow cardiac activity. After a long series of retching movements the vomitus comes up into the pharynx at the instant the top of one of the violent blood-pressure oscillations is reached. The animal then takes a full inspiration and the blood-pressure rises to or above normal.

The writers conclude that vomiting is accompanied by great changes in the circulatory and respiratory systems. There is seen sometimes a period of elevated pressure, but more frequently a sudden and pronounced drop with cardiac inhibitions at the moment of emesis, and
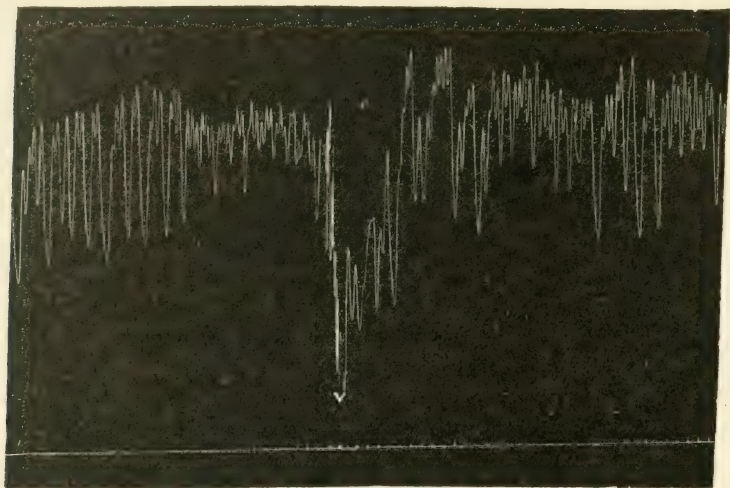
Fig. 23.—Blood-pressure tracing showing fall in blood-pressure during vomiting. The vomiting is of the quick, projectile type. *V* shows the point where the vomitus was thrown out. Time is recorded in seconds. (Brooks and Luckhardt.)

great oscillations in blood-pressure. These variations may cause rupture of bloodvessels which would not occur with the same pressure but with slower variations. The faint feeling accompanying vomiting may be due to cerebral anemia occasioned by the cardiac changes and lowered blood-pressure.

ABDOMINAL DISEASE.

Vagotonia and Abdominal Disease. Last year in Progressive Medicine, page 54, there was abstracted an article by Thies on the relation of gall-bladder disease to vagotonia. Since then Thies[1] has pursued his studies and has directed his attention particularly to the eye. When there is hypo- or hypertonus of the autonomous fibers of the oculomotor or the fibers of the sympathetic, there will be narrowing or

[1] Mitt. a. d. Grenzgeb. d. Med. u. Chir., 1915, 28, p. 415.

widening of the pupils. When the widening or narrowing is unilateral, or more pronounced on one side, there will be also a difference in the width of the palpebral fissure.

The width of the pupils under normal conditions is dependent on the contraction of the sphincter iridis on the one hand and of the dilator iridis on the other. Both are smooth muscles and are provided with nerves of the vegetative system, the sphincter iridis from the autonomous nerves, the dilator iridis from the sympathetic. The vegetative nerve of the sphincter iridis runs through the oculomotor nerve to the ciliary ganglion and hence through the short ciliary nerves to the muscles. The ganglions of the preganglion neurons lie in the nucleus of the oculomotor. The vegetative nerves of the dilator pupillæ run over the first thoracic ganglion to the last cervical ganglion through the branch of the cervical sympathetics to the first cervical ganglion. They then go to the Gasserian ganglion, follow the trigeminus, the long ciliary nerves and end in the iris.

Hypertonus of the autonomous fibers of the oculomotor nerve leads to narrowing, and hypotonus to widening of the pupil. On the other hand, hypertonus of the sympathetic fibers of the eye produces widening, hypotonus a narrowing of the pupil. Furthermore, hypertonus of the oculosympathetic causes a widening of the palpebral fissure and hypotonus narrowing, whereas the autonomous part of the vegetative nerves of the eye have no function except to produce pupillary changes.

Formerly, Thies believed that a striking difference between the size of the pupils and the width of the palpebral fissure indicated disease of the ascending colon in the region of the hepatic flexure and the beginning of the transverse colon, also disease of the rectum, but at present he believes eye changes are seen in diseases of the cecum, appendix, and other portions of the colon. Besides these abdominal organs, the urinary bladder and genitalia may, when diseased, bring about pupillary inequalities.

While both neurons of the cranial autonomous nervous system (vagus) first come into relation with each other by synapsis in the "Erfolgsorgan" and the terminal fibers of the pregangliar neurons, and the ganglion of the postgangliar neurons, first meet in the organ which they innervate (salivary glands, heart, bronchi, stomach, liver, pancreas, small intestine, kidney) the synapsis of the nerves of the sacral autonomous system (nervus pelvicus, erigens) takes place in hypogastric ganglia far removed from the organs innervated by the sacral nerves (colon, bladder, genitals). There must be therefore an entirely different stimulus of the autonomous nerves, when in one case the gall-bladder is diseased and in the other the rectum. In the first place the postganglion neuron and the terminal fibers of the preganglion neuron are affected, while in the second case the stimulus (injury) hits the terminal distribution of the postgangliar neuron.

Thies believes that the difference in the size of the pupils and the palpebral fissures has its cause often in a mechanical stimulation of the vegetative nerves, but that disturbances of internal secretion hardly play a part in the production of these changes even if they may be part of the cause. As a corroboration of this view, Thies has seen disappearance of these eye signs when the mechanical causes (adhesions) were removed.

The method of examining the patient for difference in pupillary fissure width is described exactly by Thies and in his article are numerous photographs, showing patients with eye changes. In intestinal diseases there is frequently an enormous widening or narrowing of the pupils or fissure. The farther mouthward the disease is, the less frequently are the changes seen, while the nearer the rectum, the easier the eye changes may be noted. Especially frequently are they found in diseases
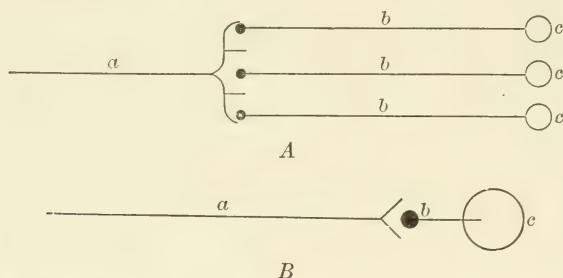
FIG. 24.—*A*, diagram of the cranial autonomous nerves with the pregangliar neuron (*a*) and the postgangliar neuron (*b*). The synapsis lies in the organ (*c*). *B*, diagram of the sacral autonomous nerves with the pregangliar neuron (*a*) and the postgangliar neuron (*b*). The synapsis lies at a great distance from the "Erfolgsorgan" (*c*) (large intestine, bladder, genitals).

of the large intestine, genitals, and urinary bladder. A difference in the size of the pupils is more frequently noted in disease of the upper reaches of the large intestine than are changes in the size of the palpebral fissure. In kidney disease eye changes are rarely noted, as is also the case in gall-bladder disease unless the latter be associated with disease of the large intestine.

After treatment eradicating the local abdominal disturbance, the eye changes disappear as a rule.

Abdominal Pain. ACCESSORY SPLEEN CAUSING ABDOMINAL PAIN. Although accessory spleens are a not uncommon finding at necropsy and at surgical operations, only two cases are reported where they seem to have caused any trouble *intra vitam.*

Alexander and Romanes[1] have reported the case of a young woman,

[1] Lancet, 1914, ii, 1089.

aged twenty-five years, who complained of abdominal pain, and on examination of whom a movable, tender mass about the size of a golf ball was found in the left upper quadrant of the abdomen. A diagnosis of mesenteric or omental cyst was made, but on operation an accessory spleen was found. The authors regard the cause of the pain to have been congestion of the viscus from tension of the omentum obstructing the return blood flow. There was no visible necrosis and there had been apparently no arterial obstruction. A similar case was recorded by Témoin.[1]

Angina Abdominis. In a study of cases, Breitmann[2] has found that the majority of patients are men, generally over forty years of age, men who have had syphilis and who are addicted to alcohol and tobacco. The commonest subjective symptom was painful meteorism with localization of the pain in the right hypochondrium, epigastrium or umbilical region. The pain is at times colicky in nature, or spasmodic in character, associated with belching or flatulence and relieved by the egress of gas from mouth or rectum. Generally the blood-pressure is considerably elevated, although it may be normal. In the severest cases, the worst pain was complained of at night, and these patients often vomited and not infrequently had hematemesis.

Of use in the treatment of these anginal attacks, vasodilator methods are recommended, particularly

Potassium nitrate	5 gm.
Sodium nitrite	1 gm.
Distilled water	150 c.c.

of which a teaspoonful is to be taken four times a day.
  Or the following:

Potassium nitrate	48 gm.
Sodium nitrite	2 gm.

of which as much as will go on the end of a knife is to be taken in a glass of water on a fasting stomach.

Closure of Mesenteric Vessels. (Rupp.[3]) The majority of the cases are men between thirty and sixty years of age, who have been complaining for a long time of a syndrome, such as is seen in chronic appendicitis, colitis, spastic obstipation, hernia, etc. Even when the onset is acute, the symptoms may be only those of tightness and a dull sense of pain in the umbilical region. In many cases vomiting and singultus are symptoms. The bowels may be constipated, but there may be

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[1] Archives Provinciales de Chirurgie, Paris, 1898, vol. vii.
[2] Zentralbl. f. inn. Med., 1914, p. 1007.
[3] Deut. med. Woch., 1915, p. 163.

bloody diarrhea. In the author's case the stools were normal. On examination, the intestine may be felt as a painful tumor, there may be dulness corresponding to the site of the tumor and peristalsis is generally not heard. The pulse is small and soft, temperature is not elevated, but the whole appearance of the patient indicates a serious illness. All symptoms vary with the duration of the trouble, which may lead to death in forty-eight hours, or may continue remittently for weeks. There is no definite sign or symptom indicating the exact nature of the disease, but mesenteric closure should be considered when the diagnosis of abdominal trouble is under consideration.

DISEASES OF THE INTESTINE.

Duodenal Ulcer. PATHOLOGY AND ETIOLOGY OF DUODENAL ULCER. A striking point brought out by the studies of Wilkie[1] on 41 cases of duodenal ulcer (necropsy material) is the fact that in only six cases had the diagnosis of duodenal ulcer been made during life. There is, no doubt, a silent type of duodenal ulcer, a type which during life gives rise to absolutely no symptoms. Although in Wilkie's cases they were old arteriosclerotic individuals, yet every practitoner has encountered young individuals with chronic ulcer with very few, if any, of the clinical ear-marks of the condition. Wilkie quotes the Edinburgh statistics to show that of 200 cases of perforated duodenal ulcers, 17 had exhibited no symptoms before the perforation. During the past year I have seen two such cases, and the diagnosis is most difficult.

Gruber, whose work I have abstracted in previous numbers of PROGRESSIVE MEDICINE, says that about 75 per cent. of the duodenal ulcers found after death had another diagnosis during life, and he, too, notes the frequency of silent ulcers in old people with arteriosclerosis. There is by no means a syndrome of symptoms of duodenal ulcer in *every* case.

In the production of a duodenal ulcer, devitalization must be the initial step, and for this various causes have been assigned, *e. g.*, (1) the lodging of an embolus in an arteriole in the duodenal wall; (2) venous embolism—the embolus arising in the portal venous system and being carried in retrograde fashion up a duodenal vein; (3) toxic devitalization of the mucosa, the result of some toxin circulating in the blood causing a degeneration, not only of the living epithelium of the bowel, but of the endothelium of the capillary bloodvessels, so that small hemorrhages take place and determine local areas of lowered resistance; (4) reflex nervous spasm of the vessels or of the muscularis mucosæ, causing small hemorrhages into the mucous membrane. In 36 of the 41 cases examined by Wilkie, evidence was sought for support of these

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[1] Edinburgh Medical Journal, 1914, ii, 196.

above-mentioned theories. He has found that in the large proportion
of cases some toxic or irritative factor, usually within the abdomen,
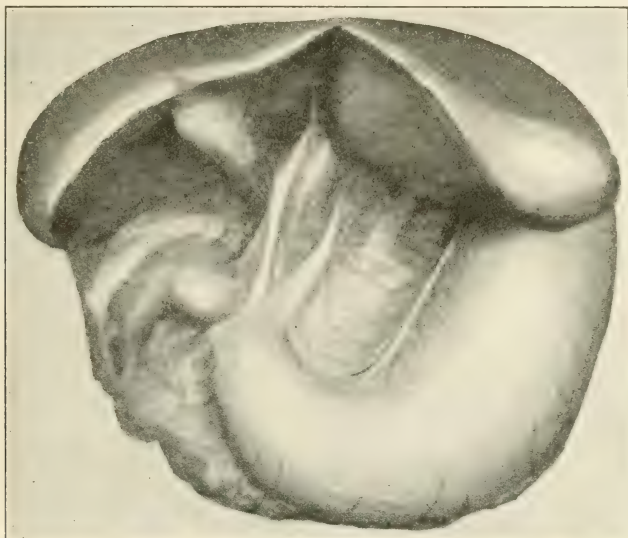
FIG. 25.—Male type of stomach filled with fluid and suspended. Note short fixed
duodenum, high pylorus, and strain on hepatoduodenal ligament. (Wilkie.)
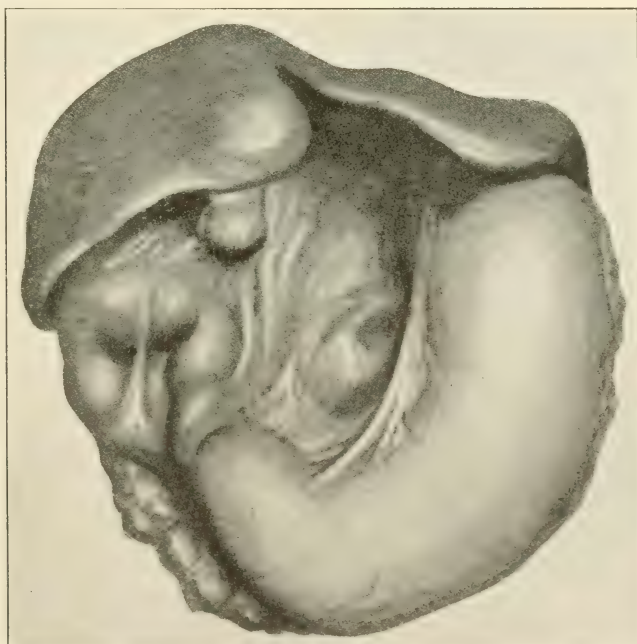
FIG. 26.—Female type of stomach. Note long and lax duodenum, low pylorus,
and strain borne by left border of gastrohepatic omentum. (Wilkie.)

and most frequently associated with the colon or appendix, is at the bottom of the trouble, although it is probable that many acute duodenal ulcers are primarily follicular ulcers from the breaking down of inflamed lymph follicles. Spasm of the muscular coats of the viscus is an important factor in determining the chronicity of a gastric or duodenal ulcer, whatever the primary cause may be.

The most common site for duodenal ulcers is on the anterior and posterior walls half an inch beyond the pylorus (85 per cent.). The roof of the duodenum just beyond the pylorus is the other common site, whereas the remainder of the first part of the duodenum, although frequently the site of scars of healed acute ulcers, is seldom found involved by a chronic ulcer. Wilkie suggests that since the ulcers occur in the boundary zone of the areas supplied by the anterior and posterior branches of the supraduodenal artery, vascular deficiency rather than a contact infection may be the explanation for the tendency to chronicity and recurrence, as well as for the frequency of the site. The vascular deficiency in turn may be due to arteriosclerosis, but it is probably usually due to spasm of the muscular coats of the duodenum induced by a slight local anemia consequent to strain on the supraduodenal vessels, this muscular spasm being favored by the increased vagotonus and the irritable condition of the autonomic nervous system.

Males were more frequently affected than females, approximately four to one. Such a difference is due to the form and position of the stomach and duodenum. In the female the stomach is longer in its vertical axis, the pylorus is on a lower level, and the first part of the duodenum is longer than in the male.

Wilkie has satisfied himself that the types are so constant as to justify the recognition of a male and a female type. In a healthy subject with good muscular tone, the stomach is buoyed up by the intestines, with little or no strain on the supporting ligaments. When the tone is impaired, the viscera tend to sag, and strain may be thrown on vascular supporting ligaments. The stomach is strung up in the abdomen by the two borders of the gastrohepatic omentum, the left one containing the coronary artery, the right one or hepatoduodenal ligament, usually containing the supraduodenal artery. When there is tension on vessel-containing ligaments, there results anemia, and anemia leads to muscular spasm in the wall of the hollow viscus supplied by the vessels. This sequence of events—tension, anemia, spasm—will be particularly likely to occur in subjects of hypertonus.

When the pylorus is low and the duodenum long and lax, as in the female type, almost all the strain is borne by the cardiac ligament containing the coronary vessels, whereas when the pylorus is situated relatively high up, when the first part of the duodenum is short and more or less fixed, a considerable amount of the strain is borne by the hepatoduodenal ligament containing the supraduodenal vessels (see

cuts). This may explain why ulcer on the lesser curvature of the stomach is relatively common in woman and ulcer in the first part of the duodenum relatively common in men.

DIAGNOSIS OF DUODENAL ULCER. Mayo,[1] dividing into four groups the means of diagnosis, says the history is of first importance, the x-rays second, the physical examination third, and the laboratory findings a poor fourth. He also claims that "a study of the history of the natural course of chronic duodenal ulcer makes the prospect of permanent cure by medical means open to question." Mayo believes there is no difference between the "medical cures" and the spontaneous remissions, for the x-ray shows no physical changes in the period of improvement, and in operating during this period no sign of healing is to be found. Surgical intervention in all cases is indicated.

Referring to the necessity of closing the pylorus, Mayo says the evidence as to the value of this procedure is not clear. He has not found that patients in whom the pylorus was blocked have had results superior to those in whom it was not blocked following simple gastro-enterostomy. In cases of perforation and hemorrhage it is advisable, but as a routine measure he thinks it had better be left undone.

As to recurrence of symptoms after operation, Mayo believes most of the poor results can be attributed to defective surgical technic; usually a gastrojejunal ulcer occurs, caused by the use of continuous silk or linen threads.

GASTRO-ENTEROSTOMY. Hartmann[2] combats the Germanic theory that when the pylorus is patulous the gastro-enterostomy opening ceases to functionate. Experimentations on dogs and x-ray examination have convinced him of the error of such a dictum, and he ascribes the failure of others to produce a properly functionating gastro-enterostomy opening as being due to the fact that the anastomosis was made in the cardiac portion of the stomach and not in the pyloric portion.

Duodenal Tube. Holzknecht and Lippmann[3] have materially shortened the time required to obtain duodenal contents, by means of various positions which they have their patients assume. The only new thing which they introduce is to have their patients lie on the back with the hips elevated, which procedure invites the passage of the tube toward the pylorus. Their method consists in having the patient swallow the tube to the mark 45 cm. then on all fours, so to speak, the patient climbs on a table, and lies on his right side with the upper body elevated. The olive tip is shoved farther down to the mark 70 cm., some secretion is aspirated and tested with congo paper. The patient rests in this position with the tube clamped. Then he is made to lie on his back, the pelvis

[1] Journal of American Medical Association, 1915, lxiv, 2036.
[2] Arch. d. Mal de l'App. Dig., July, 1914, p. 361.
[3] Münch. med. Woch., 1914, p. 1993.

is elevated, and after five minutes the tube is introduced to the 80 cm. mark. Here a neutral or alkaline secretion is obtained. When the tube is to be removed, the patient is made to swallow as soon as an obstruction (cardia, throat) is felt.

With this technic the authors have avoided the tiresome method of introducing the tube the night before as is customary, and they claim that, with their procedure, duodenal secretion may be obtained in twenty-five minutes.

Cancer of the Duodenum. Despite the insistence by some surgeons, that if chronic gastric ulcers are liable to become cancerous, the same changes should affect chronic duodenal ulcers, observations teach that cancer of the duodenum is a rare disease, and that there is no evidence that it arises in a chronic duodenal ulcer (Bland-Sutton).[1] Cancers of the duodenum are classified by Bland-Sutton as circumampullary, ampullary, and infra-ampullary.

CIRCUMAMPULLARY CANCER is difficult to distinguish from ampullary cancer and carcinoma of the head of the pancreas, and would often escape detection if it were not for the obstruction it offers to the flow of bile from the common duct,

CANCER OF THE AMPULLA exhibits remarkable peculiarities, as nowhere in the body does so small a growth lead to such grave digestive disturbance. A cancerous growth, sometimes no larger than a cherry, will block the flow of bile and pancreatic juice, and cause intense jaundice and great emaciation as a result of the obstruction to the flow of pancreatic juice. The three cardinal signs of cancer of the ampulla are painlessness, intense jaundice, and great emaciation. A feature which distinguishes it from cancer of the gall-bladder is the infrequency with which it is associated with gall-stones. The mortality is very high and the prognosis extremely grave, for death usually follows within six months of the appearance of jaundice.

CANCER OF THE INFRA-AMPULLARY DUODENUM is the commonest of the duodenal cancers. The symptomatology is that of pyloric carcinoma, but the vomited matter contains bile and pancreatic juice and is sometimes most offensive. The cancer is usually of the constricting type and the duodenum above the constriction becomes enormously dilated, so that the dilated stomach and duodenum resemble a bilocular stomach. In the infra-ampullary cancers, the presence of bile and pancreatic juice is of great diagnostic value. Pancreatic juice can be readily demonstrated by the digestion of fibrin in the filtered vomit with the addition of a few grains of sodium bicarbonate.

A successful resection of the duodenum on account of ampullary carcinoma is described by Hirschel.[2]

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[1] Lancet, 1914, ii, 931.
[2] Münch. med. Woch., 1914, p. 1728.

Constipation. ANATOMIC CAUSES OF CONSTIPATION. Duval and Roux[1] have studied especially that form of constipation occurring in individuals with lesions of the cecum and ascending colon. These lesions are generally one or more, or all, of the following group:

(*a*) Abnormal mobility of the cecum associated with ptosis and reduplication of the ascending colon.

(*b*) Membranous inflammatory pericolitis.

(*c*) Ectasia of the cecum.

The symptomatology seems to be characteristic and embraces the following three varieties of symptoms:

1. Pain, more or less severe in the right abdomen.

2. Disturbance of intestinal function.

3. A state of general impairment of health.

1. The *pain* is rarely intense, but it is persistent and continuous, and seems to be accentuated from time to time on assuming an erect posture or by muscular effort. Especially severe is the pain when the patient lies on the right side, and if the dorsal decubitus is assumed and the right leg is held extended, the pain becomes more severe. Some patients prefer on account of the latter to keep a pillow under the right leg, in order to favor moderate flexion. The pain is not always localized in the right iliac fossa, but radiates to the right lumbar region and even to the chest.

Duval and Roux have noted a nocturnal exacerbation, the pain arousing the patient from sleep about two or three o'clock in the morning. They explain it as being due to the fact that the cecum at this time receives the residue from the food taken the day before, which distends the cecum to its maximum.

Certain patients have paroxysms of pain alternating with periods of freedom from any discomfort. There is really a "crisis" of pain in the right side lasting for some hours, and relieved by the passing of abundant stools, which are sometimes diarrheic. In these instances the pain resembles very closely that seen in renal or biliary colic.

2. *Disturbances of Intestinal Function* are expressed in periods of alternate diarrhea and constipation, with constipation predominating. Laxatives seem to exert but little effect, or, rather, act with extreme difficulty, provoking profuse stools of a diarrheic nature. If the constipation persists for a long time, the retention of fecal material causes fermentative and putrefactive changes, which prove irritating to the intestines, and diarrhea results. A test diet, similar to that described by Schmidt, helps a great deal in the diagnosis, and especially important is the detection of undigested starch.

During a diarrheic attack, two kinds of stools are seen, depending on whether the mucous membrane of the colon is affected or not. If

[1] Arch. d. Mal. de l'App. Dig., 1914, 8, p. 307.

the mucosa is but slightly inflamed, the feces are slightly acid in re-
action, yellow in color, with an odor like rancid butter. They are
sticky and adhere to the walls of the vessel which contains them and
are frothy. Starch is found to be abundant, while the meat and the
fat seem to be well digested. If the mucosa is much inflamed, the
feces are alkaline in reaction, and contain numerous small shreds of
mucus. Starch is again found, but in addition the meat and the fat
are poorly digested.

3. *General Impairment of Health* follows prolonged constipation, due,
according to the authors, to a true gastro-intestinal auto-intoxication.
Anemia, cholemia, great fatigue, neurasthenic states, migraine, are all
seen. The authors claim that medical treatment is ineffective, owing to
the anatomic nature of the cause, and that the only course to pursue
is a surgical one.

Hofmann[1] is convinced that the majority of cases of chronic obstipa-
tion are of the typhus ascendens. By this is meant that the bismuth
is retained an abnormally long time in the cecum, and in the ascending
colon (eighteen hours). With this retention it is claimed that lighter
shadows, attributed to mucus, are seen, and mucus being found on
examination of the stool, Hofmann concludes that catarrhal inflam-
mations of the upper portion of the large bowel, cecum, and colon
ascendens is the underlying cause of the constipation. The mucus,
he believes, hinders the natural thickening of the intestinal content in
the cecum and ascending colon, therefore the fecal material must remain
there a longer time in order to accomplish what naturally takes place
before eighteen hours. Clinically, the features, "sheep" feces (seen in
long retention), the ribbon-like form in softer stools, painful abdominal
symptoms and tenderness of the liver, all point to spastic constipation.

In other cases the ascending colon is empty at the end of eighteen
hours, while the transverse and the descending colon contained bismuth
long after the normal time. The stool examination in these cases ·
shows mucus on the exterior of the fecal mass but no mucus in the
interior, an indication of the long retention in the lower bowel. The
clinical history reveals very few general symptoms—there may be no
bowel movement for as many as eight days. As a cause for this form
of constipation, inhibition of peristalsis in the lower large intestine
may be assumed.

MEDICAL TREATMENT OF CHRONIC INTESTINAL STASIS. Bastedo[2] uses
the synonym "constipation" for chronic intestinal stasis and believes
the treatment of the latter can often be medical, with much benefit.

Of great importance is the establishment of a regular time for defeca-
tion, and this time should be immediately after breakfast, because

[1] Arch. f. Verdkr., 1914, xx, 645.
[2] Journal of American Medical Association, 1914, lxiii, 715.

then the colonic peristalsis is best favored. This habit should be followed daily even if there is no desire to defecate, and the mind should be concentrated on the act, hence the bathroom should not be made a reading room, as an interesting book or newspaper is often responsible for failure to have a bowel movement.

On the other hand, when the desire to defecate comes, it should be gratified, for if not, the feeling tends to pass away, and if this is often repeated, the rectum loses its sensitiveness. People who for some reason can not obey the impulse to defecate are frequently the subjects of intestinal stasis.

Exercise is considered useful in procuring proper evacuations, but it is often noted that athletes are often very prone to constipation. Bastedo recommends certain exercises, such as raising the legs when lying on the back or bending the trunk when standing, etc. I have successfully made use of the following procedure in many cases: On awakening in the morning the patient is instructed to remove the pillow from under the head and to lie flat in bed. A deep inspiration is taken, and while the breath is held, the abdomen is protruded rapidly five times, a deep expiration is then made and the abdomen is drained five times. This cycle is repeated five times.

The patient should go to the water-closet at a definite time each morning, and while waiting for defecation, the same breathing and muscular exercises are performed, but between each cycle of inspiration and expiration, the rectal sphincter is alternately relaxed and contracted for several times, and the breathing exercises and these so-called rectal exercises continued. If no bowel movement results, the patient should leave the water-closet and the same performance repeated on following days.

Massage is beneficial but is contra-indicated in the presence of ulcer or any inflammatory condition. "Self massage may be carried on by rolling a cannon ball over the abdomen in the direction of the colon!" but massage performed by a trained masseur is preferable to home measures. Bastedo recommends support of the abdominal pelvic walls by means of an elastic support extending around the body from navel to symphysis.

Food should be of the kind that leaves much residue after digestion, and those foods containing cellulose (fruit, vegetables, and plant products) fill this requirement. Meats, eggs, and milk pass along as liquids and do not favor peristalsis. Vegetables and salads, lettuce, spinach, carrots, parsnips, oyster plant, turnips, cabbage, cauliflower and squash contain much fibrous tissue and cellulose.

Farinaceous foods include cereals and starchy vegetables. White bread is inferior to graham bread or bran bread. Fats may be given in the form of cream, butter, and olive oil, and are most active when they are poorly absorbed. Fruits are valuable foods, but their great disadvantage is that they promote flatulence and gastric hyperacidity.

Water drinking, excessive that is, is by no means as advantageous as is generally believed, as the water is so rapidly abstracted from the intestines that it adds but little to the bulk of the stool. A certain amount is necessary, however, to preserve the soft consistency of the feces.

Of medicinal agents, liquid paraffin has received most consideration, but, from Bastedo's investigation, nearly all fail to come up to the requirements imposed on them by the U. S. P. and B. P. He recommends the use of injection of a pint of warm olive oil at night, to be retained, if possible, until morning.

Einhorn[1] believes essentially in medical measures as opposed to surgical treatment for stasis, and expresses a view held by many internists that iliocolostomy or colectomy for these cases is unjustifiable unless there is cancer or stricture of the bowel.

Wider[2] reviews his experience with 23 cases of this nature in his service since 1912. The ages of the patients ranged from seventeen to seventy-one, and all but five were women. An operation was deemed necessary only in 3 cases, and in these the appendix and the genital organs were found normal but the cecum was very large and loose, with adhesions. In 16 cases the family physician had sent the patient to the hospital urging an immediate operation, but in all the cases the trouble was merely chronic intestinal stasis. Wider reviews the various disturbances which stagnation of the feces is liable to entail; he also analyzes the various factors liable to cause the chronic stasis, citing the details of a number of cases. In his own experience the patients paid no heed to their chronic constipation, and did not mention that intervals between stools of from two to eight days was the rule. In two cases there were symptoms of incipient peritonitis and in another an attack of colic. In four cases the vague pains in the stomach, back, and lower abdomen, with dysmenorrhea, led to the diagnosis of gynecologic trouble. In two others, dyspepsia was the main disturbance. Röntgenoscopy may be necessary in case a kink or band is suspected as the cause of the constipation. Mothers should be warned that children may be constipated even with a daily passage, and that this tendency to constipation may increase as they grow up, especially in girls. They must be taught to heed the slightest impulse to defecate, and be trained in regular habits in this respect. A few gymnastic exercises, including deep breathing, with a bland diet, will generally regulate bowel functioning in the young. At all ages, the food should contain nothing to irritate the bowel, no alcohol, coffee, sharp condiments, etc., and tobacco should be used sparingly if at all. Mayr advises exercising the abdominal and trunk muscles three times a day or deep breathing, by rising from the

[1] Journal of American Medical Association, 1914, lxiii, 1111.

[2] Abstract, Journal of American Medical Association, 1915, lxiv, 628.

horizontal to the sitting position without the use of the arms, bending the trunk forward and back and sideways during deep breathing, and bending the hip and knee while standing on the other foot. Widere adds that half a glass of cold water, fasting in the morning, with or without half a teaspoonful of cooking salt or Carlsbad salts may prove useful. Liquid paraffin is found of great benefit in some cases. It is not absorbed, he says, while it is not toxic in the least. It acts mechanically and has never failed him. The dose is one or two tablespoonfuls three times a day on an empty stomach. It has no taste, but the oily consistency is repugnant to some; if so, it can be shaken up with a little water into a fine emulsion and be flavored with lemon juice.

Effect of Morphin on Intestinal Motility. Pancoast[1] while making an *x*-ray examination of a patient suffering with obstinate constipation found unusually slow motility of the small intestine, a finding which he ascribed to a hypodermic of morphin given the night previous to the examination.

Carmin as a Diagnostic Aid in Intestinal Stasis. Having convinced himself of the harmlessness of carmin when taken by mouth, Strauss[2] calls attention to the practical results to be derived from using it as a means to determine the length of time food remains in the intestines. Normally it takes from twelve to forty-eight hours for the carmin to be recovered in the feces, although in a previous publication Strauss gave the normal time between fifteen and twenty-five hours. In some cases the carmin appears in but a single stool, in other cases it appears in the second and even the third stool—so-called fractional carmin stool. According to Strauss the length of time necessary for the appearance of carmin bears some relation to the consistency and to the specific gravity of the stool. Solid stools with a dried weight of 30 to 35 per cent. have a carmin time (C. T.) of nineteen to seventy hours. Formed stools with a dried weight of 30 per cent. have a C. T. of ten to twenty-four hours. In thick, semiliquid stools with a dried weight of 20 to 27 per cent. the C. T. is between six and twenty-four hours, and in thin, watery stools having a dried weight of 13 to 17 per cent. the C. T. is six to fifteen hours.

Strauss makes use of carmin to distinguish between the different forms of constipation. Thus, in cases of dyschezia (torpor recti, proctostasis) the red color is seen as late as the fifth or sixth day, which gives valuable assistance to the rectal examination (revealing scybalous masses) and to the abdominal examination (absence of fecal material in the ascending and transverse colon). In cases of typhlostasis, fractional emptying is seen up to the fifth or sixth day also, and is a very valuable aid in connection with the palpatory finding of a filled

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[1] American Journal of Roentgenology, December, 1914.
[2] Arch. f. Verdkr., 1914, xx, 299.

cecum and ascending colon. The carmin time alone is, of course, not valuable, and assumes importance only in combination with the means of examination. In diarrheic conditions a shortening of the C. T. indicates hyperperistalsis in the entire colon, while a normal or but slightly shortened C. T. speaks for hypoperistalsis of the distal colon, or for a thinning of the feces without increased peristaltic activity. As compared with the x-ray examination, the carmin method is, of course, less refined, but in cases where the roentgen examination cannot be made, the carmin method of itself will reveal important data.

Diarrhea. Schmidt[1] has made an interesting observation in connection with the military, and that is, that a great many soldiers have come under his care with severe gastrogenous diarrhea for which no etiologic factors could be deduced apart from the ingestion of indigestible food associated with chilling of the abdomen. The question of keeping the abdomen warm is seriously considered by military surgeons and by the soldiers themselves. Strangely enough those who are perfectly healthy do not suffer with diarrhea and have no need of keeping the abdomen protected, but it is those who have a tendency to loose bowels that get relief from warm, abdominal binders.

GASTROGENOUS DIARRHEA. The association of pancreatic achylia with gastric achylia was first recognized by Schmidt, who laid particular emphysis on creatorrhea, nucleus test, and steatorrhea, and regarded the ferment examination as of lesser value. In such cases the pancreatic achylia is considered to be but functional, but certain wellknown instances of true pancreatic achylia are on record, and are best recognized by obtaining ferments after pilocarpin injection, the ferments being absent under other conditions. Other cases of achylia gastrica are known where trypsin can be detected in the feces and in the stomach, the chief symptom in such instances being diarrhea, and the chief objective findings being those of Schmidt, noted above. Hence, it is by the stool findings alone one is unable to differentiate achylia gastrica from achylia pancreatica according to Bittorf.[2]

As causes for steatorrhea and imperfect starch digestion, increased peristalsis is held to be most important (Nothnagel), although denied by Schmidt. For the imperfect digestion of meat, increased peristalsis is one cause, but another equally important is the fact that the imperfect gastric digestion is unable to prepare the muscle fibers for pancreatic digestion. Bittorf makes the interesting observation that in a case of fistulous cecum, undigested pieces of muscle tissue were recovered, which shows that digestion of meat can take place in the cecum and even in the ascending colon, and where tryptic ferment has been recovered by E. Müller.

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[1] Med. Klin., 1915, p. 207.
[2] Deutsch. med. Woch., 1914, p. 1936.

Roentgen examination of cases of gastrogenous diarrhea discloses the fact that there was hyperperistalsis of the stomach (three and three-quarters to four hours as against the normal time of four and a half hours), hyperperistalsis of the small intestine (five and three-quarters to six hours as against six and a half hours), and marked hyperperistalsis of the large intestine particularly of the cecum and the ascending colon. Ordinarily the fecal column is propelled through the large intestine in twenty-two and a half hours, but in cases of gastrogenous diarrhea the time was between nine and fourteen hours. As a cause of the hyperperistalsis, intestinal catarrh is suspected, owing to the large amounts of mucus in the stools. The cause of the catarrh, in turn, is the deficient digestion of food due to deficient hydrochloric acid secretion, also the changes in the intestinal contents. The treatment of gastrogenous diarrhea reduces itself to the prescribing of a proper diet, hydrochloric acid and colonic lavage. To resume then; severe steatorrhea and less severe steatorrhea is a common feature of diarrhea resulting from achylia gastrica. The amount of trypsin is normal, and indicated nothing relative to the presence of a functional pancreatic achylia. The imperfect utilization of food is due to hyperperistalsis and to imperfect gastric digestions. There is hyperperistalsis to a lesser degree of the stomach and small intestine, and to a greater degree of the large intestine. The cause of the latter is intestinal catarrh.

Intestinal Obstruction; Experimental. Murphy and Brooks[1] in an experimental study of the causes of symptoms and death in intestinal obstruction, preface their protocols with such a clear and concise review of the work of other investigators that it will be of interest to reproduce it here. Although from year to year I have abstracted the researches discussed by Murphy and Brooks (see previous numbers of PROGRESSIVE MEDICINE), this summary will not be amiss in this place:

"Murphy and Vincent (1911) from experiments on cats, believed that symptoms and death in intestinal obstruction were the result of the elaboration and absorption of a toxic substance from the obstructed intestine. The toxic substance was believed to be a non-soluble substance which was destroyed by boiling. They emphasized circulatory disturbance, especially venous obstruction, as a factor in causing acute and early symptoms. The toxicity of the loop content was tested with intestine obstructed for from four to six hours. They further believed that the toxin was the result of bacterial growth.

"Hartwell and Hoguet (1912) from experimental study on dogs concluded that death in intestinal obstruction was due to the absorption of a toxic substance as a result of damage done to the intestinal mucosa. They draw no conclusions as to the source of the toxic substance. It is

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[1] Archives of Internal Medicine, 1915, xv, 392.

stated that it may be normally present or may result from stagnation. The severity of the symptoms they believe to be in direct ratio to the extent of the damage to the intestinal mucosa. The loss of body fluid is emphasized as a factor in the causation of death. The toxicity of the contents of the obstructed bowel was not studied.

"Whipple, Stone, and Bernheim, and Davis (1912, 1913, 1914) publish the result of experiments on dogs with intestinal obstruction. They believed that death after intestinal obstruction is due to the absorption of a toxin secreted by the intestinal mucosa, and that this toxic secretion can be derived from the bowel wall without a demonstrable change being present in the intestinal mucosa. The perverted secretion is held to be specific for the duodenum and high jejunum, and the toxin to be a soluble substance which is not destroyed by autolysis or boiling in non-coagulable fluid. The toxic material studied was obtained from simple obstruction of isolated duodenojejunal loops of from thirty-six to seventy-two hours' duration. A characteristic symptomatology of pathologic change following the injection of the toxic intestinal content was described.

"To summarize: All these observers believe that death is due to toxemia. Opinions are in conflict as to the solubility of the toxin and its filterability, also as regards the origin of the toxic substance. In a toxemia two factors must be present: the production of a toxin and the absorption of a toxin. The severity of the toxemia, that is, the symptoms, depend on both factors. In the experimental work referred to these two factors have not been clearly distinguished. The differences in opinion are not so striking when they are analyzed. For example, the opinion of Hartwell and Hoguet in maintaining that the severity of the symptoms depends on the extent of the damage to the intestinal mucosa is not necessarily opposed to Whipple and his co-workers in their statement that the toxin may be developed without great changes in the mucosa, for the reason that damage to the mucosa is essential to the absorption of the toxin, as is proven by the fact that the toxin is not absorbed from the normal mucosa. Also the terms 'damaged mucosa' and 'perverted secretion' may not represent different processes. The chemical and physical characteristics of the toxic material were studied by such different methods that varying statements in regard to these properties are not surprising. Murphy and Vincent worked with the content of a strangulated obstruction of from four to six hours' duration. Whipple, Stone, and Bernheim worked with the content of isolated intestinal loops obstructed for from forty-eight to seventy-two hours without strangulation. That the toxicity and the characteristics of the intestinal content should differ after a longer or shorter period of obstruction is not surprising."

Murphy and Brooks have found it necessary to repeat the work of previous investigators in order that a complete series could be

formed from which to draw rational conclusions. The latter are, that in intestinal obstruction, a toxin, the result of bacterial growth, is formed, which, when absorbed in sufficient amounts, produces definite symptoms and pathologic lesions and death. The chemical and physical characteristics of this toxin seem to vary with the length of time the obstruction has been in existence. The toxemia following obstruction may be independent of infection of the peritoneal cavity or of the general circulation, and may be caused by the toxin gaining entrance into the circulation by way of the thoracic duct. Certain it is, however, that the toxin does not pass through a normal mucous membrane. Of prime importance in the toxemia are those factors which make absorption possible, and of these factors, interference of the circulation of the obstructed intestine is the chiefest. The authors are able to trace a resemblance between the symptoms following intravenous injection of the toxin and those following intravenous injection of certain of the ptomain poisons.

Ileus Due to Gall-stones. Four cases in eight months is the astonishing record of Wagner.[1] Strangely enough, all were old women from fifty-five to seventy-three years of age.

ENLARGEMENT OF STOMACH AS EARLY SIGN OF ILEUS. Cataldi[2] states that not always does a case of ileus present the four unmistakable symptoms of obstruction, namely, abdominal pain, tympany, stercemesis, and complete retention of feces and flatus. Before all of these are apparent, it may be possible to diagnose the ileus merely by the abdominal pain and tympany, vomiting, small and rapid pulse, and pronounced dilatation of the stomach. The acceleration of the pulse may be the result of reflex action from irritation of the abdominal sympathetic. This may also be the explanation of the dilatation of the stomach which occurs early in such cases and which is of great differential importance. He describes in detail four cases in which this gastrectasia was the only symptom which seemed to exclude other affections and which pointed to ileus as the cause of the disturbances noted. The patients were adults between thirty-three and fifty-eight, and the enlarged stomach was prominently seen as the patients reclined. In some of the cases the bowels had moved up to twenty-four hours previously, and appendicitis seemed more probable than ileus, but the course of each case confirmed the reliability of gastrectasia as an early sign of ileus.

Colitis Polyposa (Virchow). There appears in the beginning of this disease to be a general colitis, producing a number of local undermining ulcers in the cecum and in the lower portion of the ileum. Clinically, there is associated with the lesions at this stage a moderate diarrhea.

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[1] Deutsch. Ztsch. f. Chir., 1914, pp. 130 and 353.
[2] Abstract, Journal of American Medical Association, 1915, lxiv, 378.

The ulcers tend to increase in number and size until nearly the whole mucous surface of the colon is involved. Clinically, during this period there is an increase in the number and a change in the character of the stools. The ulcers, as they increase in size, fuse and form large, irregular ulcerated areas, similar to those presented in Fig. 27.

The ulcerative process, though severe and chronic, is of such a character that portions of the mucosa and submucosa adjacent to and supplied, apparently, by the primary arterial branches is preserved. These portions of the mucosa and submucosa remain as ragged tags scattered over the surface of the colon. As the process ameliorates and healing begins, the irregular margins of these tags become smoothed off and remain as rounded, sessile elevations or as polypoid projections of the mucous surface. The portions of the mucosa that remain in these
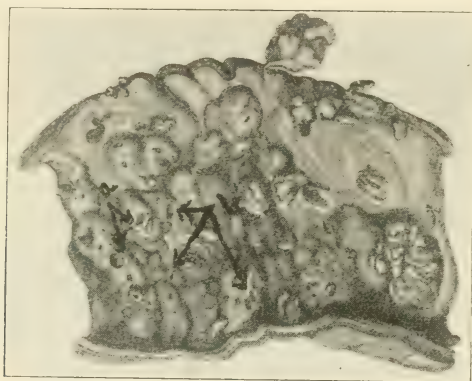
Fig. 27.—A copy of a portion of the colon from Virchow's case of colitis polyposa cystica. At *a* and *b* are to be seen open spaces. This suggests that secretions had accumulated in some of the spaces until they ruptured, which would represent a stage further in this process than we have described..

areas regenerate over the surface around the base or pedicle and, if conditions remain favorable, ultimately over the barren and denuded submucosa and together with submucosa over the muscular layer. The mucosa may thus be completely restored, and, with its numerous scattered polypus projections, present a perfect picture of colitis polyposa. Coincident with the powers of healing and later the proliferated fibroblasts begin to contract, as in the cicatrization of a wound. This leads to an occlusion of the orifices of certain of the tubules situated in the polyps and over the mucosa between the polyps. There is then an accumulation of secretions in these occluded tubules with the ultimate formation of retention cysts. These of course increase in size as long as there are secreting cells in their walls, and as there are a greater number of tubules over the surface of the polyp than over the surface of the mucosa, the polyp may appear as a collection of small cysts.

It is probably in this manner that the condition which Virchow has designated as "colitis polyposa cystica" is brought about. It is the end stage of colitis polyposa (Hewitt and Howard[1]).

Chronic Appendicitis. SOME CONDITIONS SIMULATING CHRONIC APPENDICITIS. Taunted by the charge, "the craze for appendectomy" and recognizing the grave measure of justice in the charge, Morley[2] chooses as his subject some of the conditions that may simulate chronic appendicitis, especially that variety of chronic appendicitis in which there have never been any acute attacks, but which is characterized by chronic pain and some tenderness in the right iliac fossa, accompanied, as a rule, by constipation. Lane's ileal band is held, by its discoverer, to be responsible for the above-mentioned symptom, as well as an enormous number of other symptoms, the bands causing intestinal stasis or chronic obstruction. Normally, the lower ileum rides freely
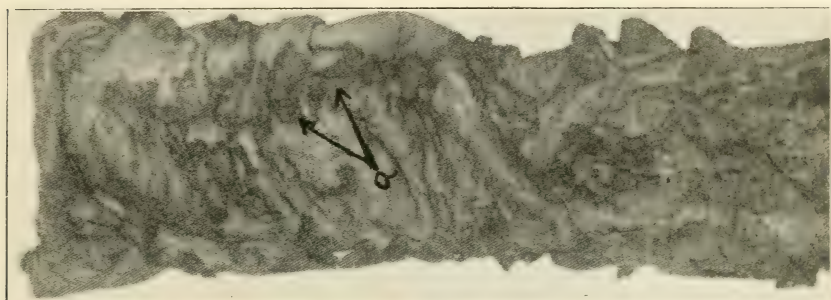
FIG. 28.—A portion of the colon from our first case. The ragged tags of mucosa and submucosa as seen at *a* are the darker areas. The specimen having been preserved in alcohol had so faded that there was little contrast between the parts.

on its mesentery right down to its junction with the cecum, and Lane's band, when present, is a fold of peritoneum on the left or inferior side of the ileum which tethers the gut down to the parietal peritoneum over the psoas muscle near the pelvic brim. Morley does not believe that this congenital fold, unless secondarily thickened and contracted by inflammatory disease of the appendix ever gives rise to the symptoms ascribed to it, and he even goes so far as to say "or indeed to any symptoms at all." In some 10 per cent. of his laparotomies the band was found, but in none did he find any distention or hypertrophy of the gut above it as compared with the gut below, nor any definite narrowing of the lumen, nor were the clinical histories or the x-ray findings suggestive of chronic obstruction. He believes, therefore, that Lane's ileal band is of little importance in the causation of disease, and the

[1] Archives of Internal Medicine, 1915, xv, 714.
[2] Lancet, 1915, i, 62.

many ingenious operations devised for dealing with it are the outcome of misdirected enthusiasm.

On the other hand, Jackson's pericolic membrane, undoubtedly does give rise to symptoms simulating chronic appendicitis, though Morley believes it does so less commonly than many authors would lead us to suppose. The membrane is a delicate vascular sheet of peritoneum, stretching from the parietal peritoneum in the back of the right loci, across the groove on the outer side of the ascending colon, to fuse with the anterior longitudinal temia on the cecum and ascending colon.

It is not an acquired or inflammatory adhesion but of congenital origin. In its presence, symptoms are due, according to Morley, not to the pericolic membrane but to the abnormal mobility of the cecum and of the ascending colon.
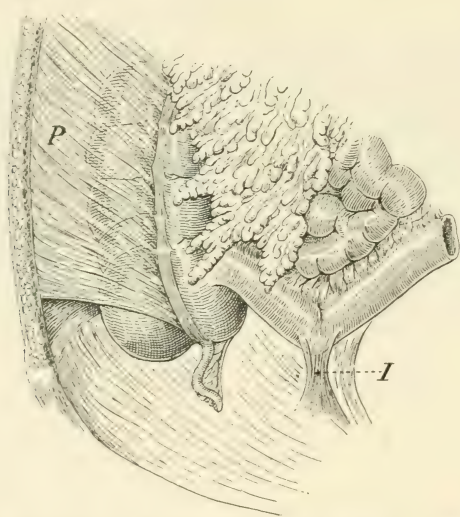
Fig. 29.—Diagram showing Jackson's pericolic membrane (*P*) and Lane's ileal band (*I*). (After Morley.)

As far as the question of mobile cecum, or, as he prefers to call it, "mobile proximal colon," as the condition does not involve the cecum only, Morley believes the symptoms due to it closely resemble those of chronic appendicitis, even actual association of the two conditions being not uncommon. In such cases mere removal of the appendix is not sufficient, but the proximal colon must be fixed.

A frequent cause, perhaps the most frequent cause, of an erroneous diagnosis of chronic appendicitis is right chronic tubo-ovarian disease, the symptoms of which are usually worse at the menstrual periods. Morley wisely recommends no more blind removals of the appendix in dubious cases, through a two-inch gridiron incision, but urges a sufficiently large incision so that not only the appendix but also all the

other structures that may possibly have been the cause of the trouble may be inspected.

X-RAY DIAGNOSIS OF CHRONIC APPENDICITIS. "In recent years it has become more and more generally recognized that chronic appendicitis often gives rise to dyspepsia, either in addition to or often in the complete absence of local symptoms. The diagnosis of such cases is often exceedingly difficult, and it is consequently a not uncommon event for an appendix to be removed without any benefit resulting. I believe that an examination with *x*-rays can furnish evidence which is sufficient to enable a definite diagnosis to be made in a large majority of cases. The evidence is both direct and indirect, the former concerns the examination of the appendix and the latter is concerned with the effect of chronic appendicitis on the rest of the alimentary canal" (Hertz).[1]

Direct Evidence. (*a*) The shadow of the appendix. Hertz claims that the appendix is much more frequently visible in normal individuals than has been generally supposed; all depends on the methods used. It can be seen in at least 50 per cent. of cases, and is visible with equal frequency in chronic appendicitis, when its shape, size, and any abnormal enlargement can at once be recognized. Its position in relation to the cecum and terminal ileum and the position of the cecum is most important. There is no diagnostic significance in the absence of an obvious shadow.

(*b*) Adhesions in the right iliac fossa. These can be recognized by deep palpation during a screen examination, and adhesions of any importance are not likely to be missed. Hertz makes use of colonic inflation, and if the appendix is adherent to the pelvic walls or to a pelvic organ other than the bladder, it does not rise under these circumstances.

(*c*) Tenderness of the appendix. Often the appendix escapes pressure when the ordinary palpation is practiced, but when palpated under the *x*-ray, tenderness may be elicited in a large number of cases.

(*d*) Hertz recommends that an *x*-ray examination of the appendix precede the barium meal so that concretions or foreign bodies may be seen.

Indirect Evidence. (*a*) The stomach. Hypertonicity of the stomach may be associated with chronic appendicitis, though it is less frequently observed than in duodenal ulcer, and is rarely of the extreme degree seen in the latter condition. A not unusual phenomenon is spasmodic hour-glass constriction of the stomach, and, after gastric ulcer, chronic appendicitis is the most common cause of this spasm.

(*b*) Ileal stasis. Appendicitis is the most common cause of retention of bismuth in the end of the ileum, and produces this stasis by giving rise to spasm or to inhibition of the normal relaxation of the ileocecal sphincter.

[1] Archives of Roentgen-ray, 1914, clxxiii, 249.

(c) Cecal stasis. Stasis in the cecum is frequently due to appendicitis, and some barium may remain in this portion of the bowel from twenty-four to seventy-two hours.

(d) Enterospasm. Chronic appendicitis is the most common cause of reflex enterospasm, the x-rays generally showing the colon abnormally narrow in various shut portions of its length, the exact position changing from one examination to another. The part most commonly affected is the proximal half of the transverse colon and the contracted segment is generally shorter than that observed in other forms of enterospasm.

(e) Dyschezia is frequently seen.

These findings of Hertz are fully corroborated by Rieder[1] in an article which in the essentials is the duplicate of the foregoing. There has always been some skepticism regarding the value of x-ray examination in appendicular lesions, but it must be admitted that both Rieder and Hertz have demonstrated satisfactorily that this method has a value, and that significant results follow its employment.

MUSCLE SIGN OF CHRONIC APPENDICITIS. Volkovitch[2] found that in chronic appendicitis, or in intervals between acute attacks, the abdomen is relaxed in the right iliac region, contrary to what is usually observed in acute appendicitis. In addition, the abdominal muscles on the right side seem to shrink and to atrophy. The more pronounced this so-called muscle sign, the severer is the appendicular lesion. This sign is absent with inguinal hernia, but Volkovitch is unable so far to tell if it is positive in other lesions of the right abdominal cavity, such as pelvic troubles, gall-stones, etc. The relaxed condition of the abdominal muscles in chronic appendicitis may lead to scoliosis on the left side, and he asserts that left-sided scoliosis should raise suspicions of a possible chronic appendicitis.

Colonic inflation has been made use of by Bischoff[3] to distinguish between adnexa inflammations and chronic appendicitis. He is convinced that as a diagnostic sign of appendicitis it has value, a conviction that all can share, but he is also certain that by its aid he is able to distinguish between salpingitis without involvement of the appendix and true appendicitis.

In my experience, salpingitis does not give typical pain in the right side. It is true, however, that pain is complained of, but it is low down in the abdomen and not in the region of McBurney's point, and I believe, with Bischoff, that the sign may have some value in distinguishing between this condition and appendicitis.

Ten Horn[4] has discovered an important sign to his mind, in the production of pain by traction on the right spermatic cord, which

[1] Münch. med. Woch., 1914, p. 1492.

[2] Abstract, Journal of American Medical Association, 1914, lxiii, 1146.

[3] Monatsschr. f. Geburtshilfe u. Gyn., 1914, xl, 398.

[4] Zentralbl. f. Chir., 1914, p. 1537.

causes a pulling on the parietal peritoneum in the region of the internal inguinal ring, with the production of pain. As important(?) as this sign may be, one is forced to admit that there are certain patients in whom this test can not be applied, and with this admission, the sign can not be regarded any too enthusiastically.

UROBILINOGENURIA AS A DIAGNOSTIC SIGN. Eisner[1] believes when there is pronounced urobilinogenuria, in the presence of clinical signs of appendicitis, that it speaks for a severe "destructive" lesion of the appendix. The test is only to be valued, he says, when the "diagnosis of appendicitis is clinically certain," for he reminds us that urobilino-genuria does occur in high fever, pneumonia, purulent disease of the adnexa, and in a host of other diseases. In mild cases of appendicitis there is no urobilinogenuria. In severe cases he believes it due to a toxic destruction of red-blood cells. Since the test is of value only when the clinical diagnosis is certain, to quote the author's words, it would seem to possess but little value. What would not the internist give for a definite means of diagnosis between pneumonia with right-sided iliac pain and true appendicitis? Many hours of anxious, watchful waiting would be avoided, but since the test is positive in pneumonia also, we can look to it for no aid in such an emergency.

APPENDICITIS AND PYLOROSPASM. Aaron[2] has previously described pain in the epigastrium induced by pressure over the appendix in chronic appendicitis, and now believes this to be due to spasm of the pylorus. With the x-rays he was able to see that when pressure was exerted over the appendicular region this caused a spasm of the lower quarter of the stomach and the first portion of the duodenum. The contraction prevented the passage of bismuth, and when the pressure was released, the bismuth could be plainly seen passing through the pyloric canal and the first portion of the duodenum. Aaron suggests that this phenomenon may explain the frequent occurrence of duodenal ulcer in chronic appendicitis, on the basis that the spasm of the pylorus and first part of the duodenum induces an ischemia, lowering the resistance of the mucosa at this point, and allowing the gastric juice to attack it.

CAUSE OF APPENDICITIS. Basil Hughes[3] advances a theory which he believes to be a new one. All cases of appendicitis are due to a mechanical cause, consisting in a rotation of the appendix about the mesoappendix, and he considers the acute inflammatory process, whether it go on to abscess formation or not, to be purely secondary to this rotation. This belief is assumed because:

(*a*) The valve of Gerlach is by no means a reliable valve.

(*b*) In almost all quiescent appendices, which have never given rise

[1] Deutsch. Ztsch. f. Chir., 1915, 132, p. 589.
[2] Journal of American Medical Association, 1915, lxiv, 1845.
[3] British Medical Journal, 1915, i, 925.

to any symptoms, intestinal organisms may be cultivated from their cavities.

Anatomically, the appendix is free to rotate on its mesentery. If the rotation be complete, the venous return is stopped, but the arterial supply is not wholly cut off, and a state of acute congestion results. Infection supervenes, and gangrene with abscesses is the usual result. This type of case is familiar, in that its onset is sudden, the pain is acute, and there is vomiting, all symptoms resembling those of a twisted ovarian cyst.

In less acute cases the rotation is not complete, and the venous blood supply is not entirely cut off.

The symptoms here are not so acute, and at operation the appendix shows some degree of rotation, and appears stiff and congested, or exhibits subserous hemorrhages.

The third type of case is that with a long mesoappendix; the organ rotates on its mesentery and thereafter recovers itself. This type gives rise to the "appendix dyspepsia." At operation, Hughes has found gastric dilatation, which he believes is due to the constant tugging on the mesentery over any length of time. An analogy is sought in the occurrence of acute dilatation of the stomach during abdominal operations in which there is any extensive handling of the mesentery.

The Causes of Rotation of the Appendix. The chief factors are:

    (*a*) A movable loaded cecum.

    (*b*) Loss of tone in the abdominal muscles.

The second of the two is the more important. A loaded movable cecum is free to move in three ways:

    1. It can descend.

    2. It can move laterally.

    3. It can expand forward.

These three conditions are those required for rotation of the appendix on its mesoappendix, and the only condition that can bring these about is constipation.

Loss of tone in the abdominal muscles is one of the commonest causes of constipation, and, later, of some amount of enteroptosis. Hughes believes that if people would preserve the normal tone of the abdominal musculature there would be fewer cases of appendicitis. He thinks a "strain" can cause an attack of appendicitis by a sudden contraction of the abdominal muscles on a loaded cecum, causing rotation of the appendix on its mesentery.

Hughes has found this contention substantiated in his army experiences since the beginning of the continental war; shortly after mobilization there were many cases of acute appendicitis, but of two brigades there has not been a case for nearly three months, speaking for the advantage of "conditioning" of the abdominal muscles in avoiding appendicitis.

MORTALITY OF APPENDICITIS. In a recent article it was stated by a surgeon that under modern scientific treatment the mortality of appendicitis still runs from 5 to 25 per cent. This statement is challenged by Turner,[1] who says that the mortality should not reach more than 5 per cent., and that if it is higher, the fault lies with the surgeon, the contributing doctors, and with the public. In Turner's own experience, he finds that cases are referred to the surgeon much earlier than they were ten years ago, and the following table shows well the decreasing mortality probably due to this fact alone.

Year.	Total cases.	Deaths.	Per cent.
Previous to 1907	66	8	12.0
1907	68	8	11.76
1908	89	7	7.86
1909	102	3	2.94
1910	107	2	1.86
1911	131	5	3.81
1912	118	2	1.69
1913	143	7	4.89
1914	181	5	2.76

Another interesting table is that showing that when cases of acute appendicitis are operated upon before infection of the peritoneum has become extensive (Groups 1, 2, 3—389 cases with 10 deaths) it is possible to keep the mortality as low as 2.57 per cent.

	Cases.	Deaths.	Per cent
Group 1—Acute appendicitis without peritonitis	62	0	—
Group 2—Acute appendicitis with localized peritonitis	219	3	1.36
Group 3—Acute appendicitis with flank or pelvic peritonitis or both	108	7	6.48
Group 4—Acute appendicitis with diffuse peritonitis	57	19	33.0
Group 5—Appendicitis with residual abscess	49	5	10.2
Group 6—Appendicitis with primary localized abscess	241	9	3.77
Group 7—Appendicitis—interval removal	257	0	—
Group 8—Appendicitis with primary complications	12	4	33.0
Total	1005	47	4.67

X-ray Demonstration of Insufficiency of the Ileocecal Valve. When a healthy individual is examined, it will be found that after six hours the stomach and small intestine are free of bismuth or barium, and that the ascending colon shows a shadow. If the bismuth remains longer than this, enteroptosis is the rule, excluding, of course, those cases of intestinal stenosis. In another group of cases there is an unusually long retention in the lower ileum, so that one might suspect a stenosis of the ileocecal valve, were it not for the fact that bismuth injection shows this to be not the case, but demonstrates very easily the passage of the contrast

[1] British Medical Journal, 1915, i, 997.

meal into the ileum, due to insufficiency of the ileocecal valve. It is claimed that food passes backward through the valve during digestion and accounts for the fact that in the cases showing shadows in the lower parts of the ileum, there is regurgitation, as it were, through the valve. Groedel holds that the pain which this class of patients exhibits is caused by the irritation of lower bowel contents on the mucosa of the small intestine, the insufficiency being due to catarrhal inflammations of the cecum and perityphlitis. Dietlen, on the other hand, believes there is little ground for classing insufficiency of the ileocecal valve as a disease entity itself, for he has found this phenomenon in chronic appendicitis and in many other conditions.

Marcuse[1] regards the insufficiency as being caused by adhesions in the cecal region, the adhesions acting in such a way as to draw the ileocecal valve open, thus permitting of the backward passage of contents from the large to the small intestine. He does not deny, however, that the phenomenon is seen in healthy individuals also, and is forced to the conclusion that while an interesting condition, it has no diagnostic significance.

Occult Blood. Tests for Occult Blood. *Phenolphthalein Test.* Although preferring this test to the better-known benzidin test, Schirokauer[2] has encountered a source of error which should be borne in mind by those employing the former tests. He found that alcohol, glacial acetic acid, hydrogen peroxide and phenolphthalein solution, of themselves, produced a red coloration, which he concludes is due to the acetic acid, as, without the latter, there was no change in color. Impurities in the acetic acid were not responsible, as the same result was obtained by employing phosphoric, lactic, or butyric acid in the place of the acetic acid. He is unable to furnish an explanation, but reports this observation for what it is worth.

Kober believes that during the reduction of phenolphthalein in strong alkaline solution, colorless salts of phenolphthalic acid are found which, on the addition of acetic acid, give rise to the phenolphthalein reaction. Schirokauer[3] agrees with this observation, and finds it practically impossible to obtain a pure phenolphthalein, that is, a phenolphthalein which does not contain the phenolphthalic acid. He is unwillingly forced to the conclusion that this test of Boas has serious drawbacks which impairs the usefulness of the reaction. Boas[4] answers this contention in an evasive and inconclusive manner, claiming that Schirokauer has not shown that the test is positive in a blood-free stool. Perhaps not, but since the reagents themselves give typical reactions, this proof is unnecessary, to my mind.

Schneider and v. Teubern,[5] at Boas' direction, have tested normal stools and have failed to attain positive tests. Just why this difference

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[1] Berl. klin. Woch., 1914, p. 1938.   [2] Deut. med. Woch., 1914, p. 1472.
[3] Ibid., p. 1617.   [4] Ibid., p. 1618.   [5] Ibid., p. 1673.

in results is difficult to determine, but Schirokauer's observations are worthy of further study.

In a subsequent paper, Boas[1] finally admits the force of Schirokauer's argument, and in order to overcome his objections, Boas makes use of a phenolphthalein-free phenolphthalein. This he procures by dissolving 25 grams of caustic potash in 100 grams distilled water, to which is added 1 gram phenolphthalein, and this mixture shaken. After the phenolphthalein is dissolved, the whole is put into an Erlenmeyer flask with metallic zinc and heated until the color disappears entirely, which takes place in about an hour or two.

The test for occult blood is carried out as follows: to the feces is added a glacial acetic acid-alcohol extract, consisting of 5 drops acetic acid in 15 to 20 grams alcohol. The phenolphthalein reagent (15 drops) is put into a test-tube, and to it are added 5 to 6 drops of 3 per cent. H_2O_2, then 2 c.c. of absolute alcohol and the whole shaken. The phenolphthalein reagent is allowed to fall on this through a funnel provided with filter paper, so that a contact ring is obtained. If blood is present, a pink or a deep red ring is seen. This new test Boas designates a "phenolphthalein ring test."

Dry Benzidin Test. Wagner[2] suggests putting a thin layer of suspected blood-containing material on a slide, and pouring on it a mixture of benzidin, 2 c.c. of glacial acetic acid and 20 drops of 3 per cent. hydrogen peroxide. By this means a quick and reliable reaction is obtained, free of contamination from soiled glass and porcelain ware, is removed, a clear reaction (blue) is always obtained, and a method particularly for office work is at hand.

Hematein. For the test three solutions are needed: A 0.05 per cent. solution of hematein in water, 40 per cent. solution of sodium hydroxide, and hydrogen peroxide of about 12 volumes strength. In the beginning, one should systematically practise with water or with an object similar to that to be tested, but containing no blood. Two test-tubes are taken, the one containing the control and the other the fluid to be examined, about 4 to 5 c.c. of each. To both tubes add 4 to 5 c.c. of the soda solution and shake. Then add to each tube 2 drops of the hematein solution, and a blue color will be obtained in both tubes. Ten drops of hydrogen peroxide are now added and the two tubes again compared. The tube containing blood will turn to violet red in three to four seconds, then to a light brown in twenty seconds, then to a pale yellow in forty seconds, while the control tube but slowly changes color in several minutes. Under the most favorable conditions the test reacts to blood in dilutions of 1 to 500,000, but practically it detects blood in 1 to 400,000. There are no substances which simulate the typical reaction of blood (Coutourier[3]).

[1] Deut. med. Woch., 1915, p. 549.   [2] Arch. f. Verdkr., 1914, xx, p. 552.
[3] Lyon Méd., 1914, cxxiii, p. 353.

OCCULT BLOOD IN ULCER AND IN CARCINOMA. The most important point in deciding this question, according to Boas,[1] is the fact that in ulcer the blood is variable, while in carcinoma it is persistent, and increases in amount. Blood in ulcer cases, under favorable circumstances, shows a tendency to abate in ten to fourteen days, while in cancer, despite the most careful dietetic and medical treatment, it never disappears but becomes persistently more intense. It must not be supposed that blood when once gone never returns in ulcer cases; this is not the case, for since relapses are apt to occur, occult blood returns very frequently.

An important point in carcinomatous ulcer is brought forward by Boas, to wit, that the occult blood may disappear for months, then suddenly it reappears, more intense than before, and persists despite all treatment.

Together with the persisting on the one hand of blood and the variableness on the other, the amount of blood present seems to have some bearing, despite the fact that we have no means of estimating it quantitatively. Boas suggests a ring test. One or two drops of the glacial acetic acid-alcohol extract overlaid on the phenolphthalein reagent, gives immediate carmin color when blood is present in large amounts. When in lesser quantities, there is no coloration, or eventually a ring on standing.

Boas goes still further and claims to be able to differentiate between diffuse non-obstructing carcinoma and scirrhus obstructing cancer. In the first variety, blood is constantly found and the reaction is very intense. The macroscopic examination itself is frequently suggestive of blood, and the patient's appearance is that of severe anemia. The reason for the intense occult blood reaction is that there is generally pyloric insufficiency and the blood is propelled into the bowels. So rapid is this that the gastric contents are frequently negative, or but a faint trace of blood is found. In the carcinomata causing pyloric obstruction, the intensity of the reaction depends on the degree of stenosis present. If the obstruction is slight, there may be an intense reaction for blood, but if the obstruction is far advanced, the stenosed pylorus permits of the exit of but small portions and therefore the reaction is but feeble. This explains the frequent negative stool examinations in gastric carcinoma. On account of the small amounts of blood in the feces, Boas recommends the phenolphthalein test, as the guaiac or the benzidin methods often fail to detect small traces. The gastric contents behave just opposite to those of the diffuse types of carcinoma, namely, there are large amounts of blood always present.

In carcinoma of the esophagus, small intestine and colon, the amounts of blood in the feces may be small also, and may even be absent. Often-

[1] Arch. f. Verdkr., 1915, xxi, p. 94.

times it is best, in the esophageal and small intestinal neoplasms, to test the contents proximal to the obstruction. In tumors of the colon, it is recommended to give a purge which will carry the blood through the obstruction and yield positive feces tests. It is most unwise, nay, even careless, to depend on one examination alone of the feces, and also to neglect the examination of the gastric contents.

In benign processes, one should not rely on the presence of blood for the diagnosis of ulcer. This diagnosis should be made even if no feces examination is undertaken. In ulcer, be it of the stomach or of the duodenum, there are varieties of occult bleeding which must be kept in mind; the pre-hemorrhagic, the post-hemorrhages, and the chronic variety. As a rule, the premonitory bleeding and the post-hemorrhagic bleeding are scarcely distinguishable from that seen in carcinoma, except it be that the pre-hemorrhagic bleeding soon produces an intense occult blood reaction, while the post-hemorrhagic bleeding becomes less intense on proper treatment, two phenomena serving in ideal instances to distinguish this form of benign bleeding from the bleeding seen in malignant processes. The most common of the three varieties of benign and occult blood is the chronic form. The latter is detectable only by means of the most sensitive tests and here Boas calls to his aid his phenolphthalein test. It is because of the small amount of blood in the feces, which have been searched for by tests not sensitive enough to detect minimal traces, that accounts for the disfavor with which surgeons regard feces examinations.

As regards the behavior of fecal blood during the treatment of the patient, Boas suggests that under proper treatment, first subjective pain disappears, then pressure tenderness, and after ten to fourteen days the occult blood disappears. This is the general rule, and Boas has rarely found it necessary to have surgical intervention in his ulcer cases, except in those with complications. "If English, American, and also German surgeons see so many ulcer cases, if the reports of such observations are yearly becoming more numerous, it indicates, to my mind, that the internist has not recognized the condition, and has not treated it properly."

Nutrient Enemas. Scheel[1] tabulates the metabolic findings and other details in 4 out of 16 cases thus investigated over several weeks on different types of rectal nourishment. The findings testify to the good absorption and utilization of suitable enemas, thus sparing the reserves in the body and supplying quite an essential part of the nourishment required. It was found that milk and eggs irritated the rectum and were not absorbed properly, not even when pancreas extracts were given with them. The best results were obtained with meat amino-acids. The 10 grams of nitrogen were given with 80 or 75 grams of grape sugar

[1] Abstract, Journal of American Medical Association, 1915, lxiv, 1804.

in the course of the twenty-four hours, fractioned in two or three enemas. About 250 c.c. of fluid were found the best amount for a single enema. The osmotic concentration was kept at about the same as that of the tissues, to avoid irritation. Not more than 25 grams of sugar should be given at one time. He found the deep method impracticable for reasons he enumerates. The nutrient enemas were kept up for nearly three weeks. It is possible in this way to supply 400 or 600 calories daily. As the nitrogen balance is thus maintained, the reserves of fat in the body are drawn on for the balance of the calories required, and this fat loss can soon be made up again at the close of the course. All the patients had had hematemesis from a gastric ulcer. Most of the amino-acids were made in the hospital by long-continued digestion of meat or milk by trypsin-erepsin.

DISEASES OF THE LIVER.

Functional Tests of Hepatic Insufficiency. Chesney, Marshall, and Rowntree[1] have studied the carbohydrate metabolism, nitrogenous metabolism, urobilinogen, fibrinogen, lipase, phthalein, fibrinolytic ferment in a series of 45 cases, in nearly all of which some abnormality of the liver was thought to be present.

PRACTICABILITY OF THE TESTS. The phthalein test involves an intravenous injection and careful collection of stools for forty-eight hours. Undesirable features are connected with it: (1) The quality of red color obtained in certain instances makes accurate quantitative estimation difficult in 10 to 20 per cent. of the cases. (2) Thrombosis, although not serious, has occurred at the point of injection.

Fibrinogen determinations are difficult in the presence of severe anemia. Lipase determinations are simple to do. The determination of the total non-protein nitrogen, urea nitrogen, and amino-acid nitrogen of the blood can not be carried out in severe anemic states. Technically simple, this method is nevertheless time-consuming. The nitrogen partition requires less time. Galactose can be administered without discomfort to the patient, but with levulose at least 25 per cent. reject it for one or more reasons. The fibrinolytic ferment is readily demonstrated, while urobilinogen determinations in the urine are valueless unless made daily for a period of two weeks, and unless associated with urobilin determinations in the feces.

Of all these tests, the phthalein excretion, the fibrinogen and the nitrogen partition in the blood and urine are of decided value in revealing the presence and extent of functional involvement, while diagnostically speaking, the fibrinolytic ferment is of great value. Functional hepatic tests are by no means so conclusive as the renal tests.

[1] Journal of American Medical Association, 1914, lxiii, 1533.

Believing the galactose test and the phenoltetrachlorphthalein (thaleine) test promised more than the other functional tests, Sisson[1] has limited himself to the study of these two. As to the galactose test he thinks it may be of great value in differentiating icterus catarrhalis from other conditions showing biliary stasis. In cirrhosis without stasis this test is rarely positive. Curiously enough, Sisson can find no apparent relation between the excretion of galactose and phthalein, and he considers it advisable to study the latter test much more thoroughly before definite conclusions are drawn. He admits, however, that it offers a means of diagnosing certain cases of cirrhosis from neoplasms of this organ.

An excellent review of all the modern methods of testing hepatic function has been prepared by Steiger.[2] It is an article which can not be abstracted, but I give the author's conclusions based on his readings. He draws the inference that in alimentary galactosuria and levulosuria, with pathologic urobilinuria, positive camphor glycuronic acid reaction and diminution of fibrinogen in the blood plasma, one may find valuable aids in diagnosing hepatic insufficiency. Krumbhaar,[3] in an article of a similar nature, believes the levulose and galactose tests are present in too many non-liver cases to be considered reliable. The amount of urea in blood or urine is unsatisfactory.

UROBILIN. The significance of urobilinuria has often been discussed and its value as a sign of hepatic disease often questioned, because of the fact that it is seen so frequently in conditions apart from the liver. Labbé and Carrié have recognized this criticism and have answered it so satisfactorily to themselves that they conclude that urobilinuria is by far the best index of hepatic integrity. They have this to say:[4]

For the appearance of urobilinuria the combination of two factors is necessary, namely:

1. Permeability of the bile passages.
2. Functional hepatic disturbance.

Urobilinuria possesses above all an hepatic significance, any other means of production is exceptional, such as by hemolysis. They do not believe, as do certain German writers, that urobilinuria is a constant symptom of anemia. Perhaps in hemolytic icterus it does occur, but even in this instance it is doubtful if the liver is not affected to a certain extent.

Urobilinuria must not be considered the simple result of cholemia, for there are cases of hypercholemia without urobilinuria and cases of

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[1] Archives of Internal Medicine, 1914, xiv, 804.

[2] Correspondenz-Bl. f. Schw. Aerzte., 1914, pp. 1025 and 1057.

[3] New York Medical Journal, 1914, ii, 719.

[4] Ann. de Méd., 1914, i, 643

urobilinuria without cholemia. The reduction in the tissues of bile pigment into urobilin is exceptional, and the amounts thus formed are clinically negligible.

As a rule, urobilinuria denotes functional disturbance of the liver. This is the opinion of Hayem and of Chauffard, the latter writing: "For my part, I have always insisted on the preponderating role of the liver cell in the production of urobilinuria. Whether one holds the intestinal theory or whether he leans toward the hepatic theory, it is nevertheless the liver cell which speaks the last word."

Urobilinuria is seen in every case where the liver is functionally inefficient, no matter whether the lesion is serious and irreparable or whether it is mild and transitory in nature.

In the course of serious diseases (cirrhosis, cancer, abscess), in the course of less grave conditions (chronic passive congestion, cholelithiasis, etc.) urobilinuria is constant whether there is icterus or not, but it disappears as soon as obstruction of the bile passage takes place. We have seen a patient with hypertrophic cirrhosis and intense urobilinuria, with disappearance of the latter due to biliary retention from an intercurrent acute angiocholitis.

In the course of functional disturbances of the liver without any apparent organic lesion of the organ, urobilinuria is as frequently seen. It is very common in the course of infectious diseases (typhoid, scarlet), and, in general, whenever there is pyrexia. It is often seen in gastric intestinal disturbances (gastritis, dyspepsia, enteritis) and even after simple indigestion, following indiscretions in diet. It may appear in a single specimen of urine, the eating of poor meat or "high" game produces urobilinuria. Labbé has seen urobilinuria follow the ingestion of 150 grams of glucose when it was the only expression of hepatic insufficiency, there being no alimentary glycosuria.

From the above it will be seen that urobilinuria is a symptom of the greatest frequency, but compared with other tests of hepatic insufficiency it is much more constant and much more delicate. Alimentary glycosuria is a variable quantity, metabolism experiments are positive only in the event of marked disease of the liver, as is also acidosis. Although the most frequently seen, urobilinuria is not always seen in hepatic disease. There is, in medicine, no symptoms constantly constant. If there is acholia, or renal insufficiency, it is not seen even in advanced cases, and hence one often misses it in terminal cases. Therefore absence of urobilin in the urine is not a guarantee of the integrity of the liver.

Prognostically speaking, there is a relationship between the intensity of the disease and the degree of urobilinuria, although there is no absolute rule as to this. When urobilinuria is constantly seen, the case is to be considered grave.

Hepatic Function and Ductless Glands. Whipple and Christman[1] have studied the effect of glandular extirpation on the phthalein output.
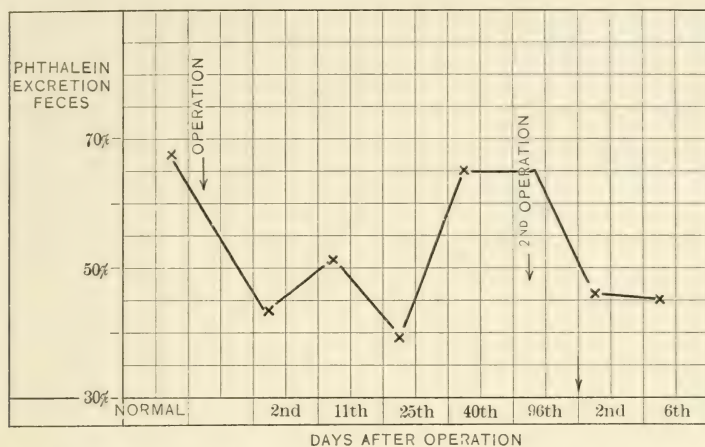
Fig. 30.—Dog 13–56.—Adrenal extirpation. (Whipple and Christman.)

The adrenals, pancreas, thyroid and parathyroids, and hypophysis were extirpated in different experiments, and the authors believe that the liver is very much concerned in the derangement that follows the
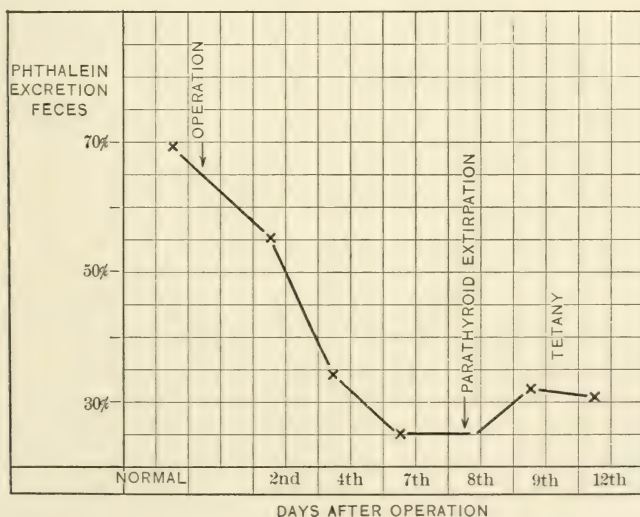
Fig. 31.—Dog 13–20.—Pancreas extirpation. (Whipple and Christman.)

removal of the ductless glands, and they consider it probable that the disturbance of liver function may be an important factor in the general

[1] Journal of Experimental Medicine, 1914, xx, 297.

symptom-complex of ductless-gland insufficiency. They have obtained the following suggestive results, namely:

1. Adrenal insufficiency produced by extirpation of three-fourths or more of the gland tissue will be associated with a drop in the phthalein output. With hypertrophy of the adrenal fragment, the excretion comes back to normal, but may fall again when more adrenal tissue is removed.

2. Pancreatic insufficiency causes a progressive fall in phthalein output, this fact having a direct bearing on the question of diabetes.

3. Parathyroid insufficiency with tetany causes no decrease in the phthalein output, but at times a rise above normal. Parathyroid tetany may cause hyperactivity on the part of the liver cells.

4. Thyroid insufficiency does not change the phthalein curve.

5. Hypophysis insufficiency shows an initial fall in the curve followed by a return to normal and a final drop in the last few days before death.

Cirrhosis of the Liver and Tuberculosis. In a short article in the *Bulletin de l'Academie de Médecine*, June 23, 1914, p. 874, Legay wishes to take exception to the belief that hepatic cirrhosis is tuberculous in nature. He offers proof that even in the presence of tuberculous lesions in other portions of the body one can not conclude that the cirrhosis is tuberculous, as the histologic appearance of the organ in the two conditions has nothing in common. He offers further proof in the fact that in many cases of pulmonary tuberculosis, and of tuberculosis in other organs, no change is seen in the liver. When changes are seen, the lesions are so characteristic as to offer no ground for any failure to recognize them as being tubercular in nature.

Syphilis of the Liver. Cheyney[1] advises the employment of the Wassermann reaction in all conditions simulating cirrhosis of the liver, claiming to have seen good results follow specific treatment in cases in which the Wassermann reaction is positive. He recognizes, of course, that not all positive tests indicate syphilitic hepatitis, but no harm can be done by instituting antisyphilitic treatment and often marvelous improvement will be found to be the sequel of such therapeutics.

In Vitou's[2] four cases, two simulated Laennec's cirrhosis; the third simulated a subacute rheumatism plus the liver trouble, and, in the fourth, anemia dominated the clinical picture. The irregular shape and large size of the liver, the exudate simulating ascites, and the positive Wassermann reaction, to him, pointed to a gummatous affection of the liver. Under mercurial treatment all symptoms retrogressed, except that the liver still remained larger than normal. Syphilitic hepatic disease shows a great tendency to recurrence, and treatment should be cautious, and the liver should be spared all extra work for a while.

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[1] American Journal of Medical Sciences, 1914, cxlviii, 157.

[2] Abstract, Journal of American Medical Association, 1915, lxiv, 1694.

He advises absolute rest in bed, not getting up for any purpose, nothing but water by the mouth for a day and a half, but plenty of this, up to three liters. Then skimmed milk in small amounts at frequent intervals, until the end of a week's time, with enemas if the patient is constipated. In all four cases the spleen was much enlarged as well as the liver, and all had ascites; one patient at first required tapping every week. In one woman of forty-one, extreme anemia, fever, and much expectoration suggested tuberculosis but no tubercle bacilli were found. The skin reaction was negative, as was also the Wassermann, but the large size of the liver and spleen and the irregular pupils suggested syphilis, and complete recovery followed mercurial treatment.

Icterus. Examination of the Duodenal Contents in Jaundice. There is every reason to suppose that a tube which can enter the duodenum and rest opposite the exit of the bile and pancreatic ducts, should disclose most instructive data pertaining to the patency or non-patency of these structures. The duodenal contents vary in each type of case, and it is held by Crohn[1] that there is a duodenal picture characteristic of each type of disease.

Cholecystitis and Cholelithiasis. In this type of case the findings are constantly those of open biliary and pancreatic ducts. The bile is abundant in the duodenum, usually heavy, viscid, and dark green, and an excess of mucus is visible. Apparently a stone passing down the ducts does not, at any time, more than slightly obstruct the lumen. The pancreatic duct is always patent.

Catarrhal Jaundice. In one case, which was the only one offered for duodenal examination, an abundant, thin, yellowish bile was obtained, which contained normal pancreatic ferments.

Impacted Common Duct Stone. Bile was constantly found and the pancreatic ferments were present in normal amounts. It will thus be seen anew that obstruction by a stone is rarely complete. In cases of protracted jaundice with clay-colored stools, bile in the duodenal contents, even when in diminished quantities, speaks for calculus, while its absence is in favor of malignancy.

Stricture of the Common Duct. Three cases of postoperative stricture of the bile duct were studied. In two instances no bile was found, while pancreatic ferments were abundant. In the third case there was a slight diminution in bile but the pancreatic ferments were again normal. Stricture of the bile duct resulting from choledochotomy may be complete or incomplete and may be mistaken for carcinoma.

New Growths Involving the Biliary System. In thirteen out of fourteen cases of neoplasm, a complete closure of the bile duct was noted, furnishing a reliable sign of diagnosis of new growth. In six cases no pancreatic ferments were found, thus localizing the tumor

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[1] Journal of American Medical Association, 1915, lxiv, 565.

at the junction of the bile and pancreatic systems in the head of the pancreas. The latter sign is said by Crohn to be infallible.

PANCREATITIS. There are always diminished amounts of pancreatic ferments.

HYPERTROPHIC CIRRHOSIS OF THE LIVER. Uniformly, a superabundance of bile and an overactivity of pancreatic ferments were found. The bile is thin, light yellow, and watery, and flows in large amounts, while the ferment, despite the large quantity of bile, are unusually active.

ABSENCE OF TRYPSIN IN THE STOMACH IN ICTERUS. Austin[1] studied ten cases, representing the extremes of malignant jaundice, (1) where cancer was the cause of the obstruction, either by pressure of the growth on the biliary ducts or by the direct involvement of the same by metastases from the original focus (2) and of simple cholangeitis or catarrhal jaundice, generally conceded to be due to a mild bacterial infection of the choledochus from the duodenum.

The routine method was to wash out the fasting stomach, give a glass of oil, and immediately a teaspoonful of calcined magnesium oxide suspended in water. After an interval of forty-five minutes, the contents of the stomach were withdrawn, and the clean fluid beneath the oil layer was tested with congo and litmus, and if either reacted enough, $\frac{n}{10}$ sodium hydroxide solution was added to make it neutral. Then, after filtration, five test-tubes were made to contain 2 c.c. each of a solution of 1 gram of purified casein in a liter of 0.1 per cent. sodium carbonate solution, varying quantities of the gastric contents ranging from 0.1 c.c. to 0.5 c.c. were added together with a few drops of chloroform water, and the whole allowed to remain in a brood oven for twenty-four to thirty-six hours. At the end of that time a few drops of saturated sodium acetate solution were added, when if the casein were digested no precipitate occurred.

Austin believes that the absence of trypsin in the presence of icterus may mean conjoint cholangeitis and pancreatitis, cholangeitis with more pressure on the outlet of the pancreatic duct, pressure of the enlarged head (carcinomatous) of the pancreas on the common duct, or mere pressure of a growth originating in the ducts on the pylorus. He fails to see how the presence or absence of trypsin under any of these conditions is going to be of any aid in diagnosing the particular pathologic state.

Production of Bile Pigment Outside of the Liver. It is generally accepted now that when extravasated blood is left between the tissues or in some cavity, there is true production of bile pigment. The amount of bilirubin thus produced is very minute, but its presence in the accumulated blood may be regarded as a sign that the extravasation is not of recent

[1] Boston Surgical and Medical Journal, 1914, clxxi, 22.

occurrence, that is, if the bilirubin content of the fluid is higher than that of the blood serum (Van den Bergh and Snapper[1]).

A second article by the same authors[2] is devoted to the production of bile pigment in the spleen in cases of pernicious anemia, Banti's disease, hemolytic icterus and other affections accompanied by excessive hemolysis. The blood from the splenic vein was compared with blood from a peripheral vein immediately after death or at operations permitting this. In four operative cases and in two fatal cases it was found that the blood serum from the splenic vein constantly contained more bilirubin than the peripheral blood; in some cases there was a three-fold difference. The spleen serum was much darker colored. Everything indicated that the bilirubin in question had been formed in the spleen.

Primary Carcinoma of the Liver. Apart from the unusual occurrence of primary cancer of the liver, the case of Freeman[3] which occurred in a male child, three years of age, is particularly interesting. The previous history was that of abdominal swelling extending over eight months, and the striking points of the case were, in addition to the primary malignant growth in such a youthful individual, the absence of all secondary deposits, and until the end was near, the absence of pain, tenderness, or of decided dyspepsia or anorexia.

CHOLELITHIASIS.

Frequency of Gall-stones. Further statistics as to the incidence of gall-stones are furnished by Hesse[4] from St. Petersburg. The material comprised 17,402 autopsies in the last ten years, and refers mostly to the laboring classes. Only 378 cases were found (2.17 per cent.), while the collective statistics of nineteen European and American authors, with 80,802 necropsies, the frequency averaged 5.94 per cent. Males were found less frequently affected than females, 0.73 as against 4.7 per cent., and the sixth decade was the most common period of life. In 84 per cent. of the cases the gall-stones had given no sign of their presence during life (sic). Cancer was found in only ten cases.

Gall-stones the Result of Transient Thickening of the Bile. Rovsing[5] asserts that recent research seems to have established that just as the urine becomes abnormally concentrated during the course of fever the bile is liable to become less fluid. In the inspissated bile, precipitation is prone to occur and the elements thrown down may result in concrements. Among the facts on which he bases this assertion are the results of Boysen's chemical study of the gall-stones found in 200 cadavers. The young, freshly deposited calculi and also the nucleus of all other

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[1] Abstract, Journal of American Medical Association, 1915, lxiv, 1538.
[2] Abstract, ibid., p. 1624.   [3] Lancet, 1914, ii, 157.
[4] Abstract, Journal of American Medical Association, 1914, lxiii, 364.
[5] Abstract, ibid., 1915, lxiv, 1460.

kinds of biliary concrements he found consisted of bile pigment and calcium. Other elements of the bile are precipitated on this nucleus or are drawn to it by osmosis, especially cholesterin. The condition during pregnancy and febrile disease are liable to favor this inspissation. The concrements resulting therefrom are all of about the same age, confirming the transient nature of the cause producing them and explaining why new ones do not develop after the crop has been removed. Boysen found invariably that the gall-bladder was healthy when the gall-stones were of the small, primary, bile-pigment calcium type.

A still more conclusive argument in favor of this assumption of the origin of gall-stones is, that systematic bacteriologic study of the gall-bladders removed in 320 cases at Rovsing's clinic between 1899 and 1914 showed that the organ was entirely sterile in fully 54 per cent., without a trace of infectious processes. The proportion in aseptic cases showing the different types of gall-stones ranged from 52.7 per cent. of 55 cases in which a single large stone was found, to 77 per cent. of 27 cases presenting the small mulberry-shaped stones. These findings disproved Naunyn's theory that gall-stones are deposited in consequence of an infectious process. Other data cited also discredit this hypothesis, especially the fact that the symptoms of cholecystitis always follow, never precede, the gall-stone formation. When the pigment and calcium are precipitated from abnormally thick bile, the resulting concrements may or may not irritate the gall-bladder and ducts enough to set up inflammation. Rovsing reviews all the theories proposed concerning the pathogenesis of gall-stones and shows the fallacies of each, while he dilates on the way in which all the phenomena connected with cholelithiasis are logically explained by precipitation as the result of the bile under some temporary condition inducing transient inspiration.

It is sometimes a difficult question to decide whether in a given case there is only inspissated bile or true gall-stones; and, in such cases, the x-ray furnishes doubtful aid. The cases of inspissated bile rarely give the typical history of biliary colic and are apt to be younger individuals than those suffering from true cholelithiasis. The symptoms are those of chronic digestive troubles plus local tenderness and subjective pain over the gall-bladder region. The treatment is essentially medical, and consists of proper dietetic regime together with medication which is conducive to a free discharge of bile. I have made use, successfully, of nitrohydrochloric acid with the meals, followed by a capsule consisting of menthol, oxgall, salicylic acid, and phenolphthalein in such cases.

Gall-stones after Typhoid Fever. An unusually rapid development of gall-stones after typhoid is reported by Ballarine.[1] The patient was a girl of sixteen years of age. The temperature did not return quite to

[1] Abstract, Journal of American Medical Association, 1914, lxiii, 1706.

normal for a month after the main typhoid symptoms had subsided. During this convalescent period she had several attacks of gall-stone colic, and passed two concrements. Typhoid bacilli were cultivated from the centre of each, but none was found in the stools during or after convalescence. The gall-stones were of pure cholesterin, pigmented in the centre.

Roentgen Diagnosis of Gall-stones. Cole,[1] in particular, is certain that he can demonstrate gall-stones in all cases in which they are present, and owing to the fact that the diagnosis can be made in such a large number of cases, the negative diagnosis has become far more important than it was previously considered to be. One will be surprised to hear, and overjoyed to learn, that from the roentgenologist's stand-point it is much easier to detect a stone in a fat individual than in wiry, poorly nourished people who have no fat to outline the gall-bladder, and whose muscle is nearly as dense as bone.

Chemistry of the Stomach in Cholelithiasis. Ohly[2] has studied 87 cases of uncomplicated gall-stones, and has found, in 19 cases, hyperacidity; in 13 cases, normal gastric chemistry; and in 46 cases, sub-, or unacidity; in other words, in the great majority of cases, hypoacidity is the rule. The acute cases are generally associated with hyperacidity.

Achlorhydria in Gall-stones. Hernando[3] calls attention to the high percentage of cases showing lowered gastric acidity. This must be regarded as merely coincidental in his cases, for there seems to be no definite gastric picture in gall-stones, normal figures, hypo- and hyperacidity being all frequently observed.

Return of Symptoms after Cholecystectomy. Although cholecystectomy is so frequently practiced, and although surgeons, and even internists, are convinced that it is the operation of choice in uncomplicated cases of cholelithiasis, it is nevertheless sufficiently well recognized that not infrequently the patient has a recurrence of symptoms, which make him doubt the efficacy of the operation. What the cause of these symptoms is no one seems prepared to say,[1] although it is admitted that the gall-bladder has some other function than that of a passive receptacle for bile. As stated last year, the lesson to be learned from Rost's excellent work is, that the sphincter-like action of the ampulla of Vater is interfered with by the removal of the gall-bladder, so that the latter becomes "incontinent," as he expresses it, and bile flows continuously instead of intermittently. Eventually, however, there comes an intermittent emptying, just as happens when the biliary tract is intact.

Graff and Weinert,[5] surgeons, admit that in a certain number of cases

[1] Cole and George, Boston Medical and Surgical Journal, 1915, clxxii, 326.
[2] Arch. f. Verdkr., 1915, xxi, 128.
[3] Arch. des Mal. de l'App. Dig., 1914, p. 274.
[4] PROGRESSIVE MEDICINE, December, 1914, p. 99.
[5] Beitr. f. klin. Chir., 1914, xcii, 339.

no improvement is to be noted, but that symptoms recur, "and from the stand-point of the patient it is immaterial whether they are due to new stones or to other causes." Excluding those cases in which stones have been left behind in the common duct, Graff and Weinert believe that practically all symptoms following operation are due to adhesions. Adhesions can produce all symptoms of biliary colic, as is shown in one of their cases, and they make a plea for technical improvement, so that this unfortunate complication will occur less frequently. They offer suggestions for avoiding adhesions, suggestions in the nature of operative technic, the discussion of which is left in other hands.

Reformation of Gall-stones after Operation. Stanton[1] believes that the majority of such cases are those in which gall-stones have been overlooked at the time of operation; and provided no foreign body (threads from gauze, unabsorbable suture material) is left in the gall-bladder or ducts after operation, "the reformation of gall-stones is so rarely observed as to constitute almost a negligible factor in gall-bladder surgery." He reports an undoubted case. Lameris'[2] case was apparently a case of recurrence, as the patient's gall-bladder had been removed two years before and the bile duct carefully searched. The structure of the gall-stone found at the second operation, however, disproved the idea of recurrences as the structure in the centre unmistakably indicated that it was a calculus overlooked at the first operation, which had gradually enlarged by incrustation to its present size.

Stanton does not believe that cholecystectomy affords a much greater immunity against reformation of calculi than does cholecystostomy.

Examination of the Duodenal Contents as an Aid in the Diagnosis of Gall-bladder and Pancreatic Affections. Einhorn[3] deduces the following:

1. The macroscopic appearance of the bile is of great diagnostic import. If it is golden yellow and clear, it usually indicates a normal gall-bladder. When the fresh bile looks greenish yellow and is somewhat turbid, it portends a diseased state of the gall-bladder, which frequently contains gall-stones. Golden-yellow bile containing mucus is frequently observed in catarrhal jaundice. A pure golden-yellow bile may, however, occasionally exist, notwithstanding the presence of gall-stones.

2. Duodenal contents containing bile and pancreatic secretion permit of gauging the pancreatic function.

3. The presence of the three ferments in sufficient quantity speaks for a normal activity. If one of the ferments is constantly absent, it usually indicates chronic pancreatitis. A tumor of the pancreas may exist notwithstanding the presence of all three ferments. This

[1] Annals of Surgery, 1915, lxi, 226.

[2] Abstract, Journal of American Medical Association, 1914, lxiii, 1064.

[3] American Journal of Medical Sciences, 1914, cxlviii, 490.

apparently surprising fact finds its explanation in the circumstances that the tumor has yet left enough healthy tissue in the rest of the pancreas to continue its function in an undisturbed manner. Similar conditions are occasionally encountered in the organs affected by growths (stomach, kidney, etc.).

4. Duodenal contents persistently revealing neither bile nor evidences of pancreatic secretion speak for a mechanical obstacle just above Vater's papilla (usually stone).

The best way Einhorn has found to obtain the duodenal contents for examination of bile is either to have the patient in a fasting condition, having inserted the tube before retiring, or else about a half hour after the ingestion of a cup of tea with sugar or clear bouillon, the patient having taken the duodenal tube early in the morning a few hours previous to the examination.

The contents should be removed carefully, aspirating slowly with the syringe every minute or so, with frequent intermissions. In case the aspiration has been performed five to ten minutes and nothing has yet appeared, two means may be employed to attain the desired end. One is by the injection of secretin subcutaneously and aspirating three to five minutes later, the other consists in employing duodenal lavage. To do this the piston of the syringe is slowly withdrawn, the empty barrel is filled with water (blood temperature) and raised. The latter usually begins to flow into the duodenum; if it does not, slight pressure may be exerted by pushing the piston into the barrel for a half to three-quarters of a minute in order to start the flow. The piston is again withdrawn; the flow, however, continues. Before the barrel is completely empty it is lowered quickly, in order to insure some of the fluid returning.

DISEASES OF THE PANCREAS.

Pancreatitis. FUNCTIONAL TESTS OF PANCREATIC INSUFFICIENCY. Crohn[1] has contributed an important article based on his studies of 120 patients, using the duodenal contents first for analysis. Only 17 of these showed a deviation from the normal, the remaining 103 exhibiting a "monotonously uniform" strength of ferments. Although disappointing in a way, this high number of normal pancreases has served the purpose of establishing the existence of a normal standard of ferment strength for the external secretion of the pancreas. Testing for one ferment alone is unreliable, and all three should be estimated. Of the three, lipase is undoubtedly the most variable, trypsin the most constant and the most valuable. One can not utilize the amount of duodenal contents collected as an index of the amount of pancreatic juice secreted, as some cases yield 4 or 5 c.c., others 15 to 20. The

[1] Archives of Internal Medicine, 1915, xv, 581.

strength of the ferments remain constant despite the variation in the amount of fluid obtained.

In most cases of organic disease there is a diminution in ferment activity, a finding in concordance with all observers. The best means of estimating this diminution is by examination of the duodenal contents, and Crohn believes that stool analyses are totally unreliable. He has been able to find no enzymes in the stools in instances where there was ascertained to be normal ferment action in the duodenal contents, showing that with a normal duct or normal pancreatic secretion the stools may fail to show ferments.

One finds that diminished enzymes in the pancreatic secretion may occur with severe disease elsewhere than in the pancreas (Addison's disease, pernicious anemia, general carcinomatosis), although this occurrence is so unusual that it may be considered as an unimportant factor. In Crohn's 120 cases it occurred only five times. Hence, it is to be said with all fairness that diminution of ferment speaks strongly in favor of pancreatic disease.

Pancreatitis, if of the interlobular type, may exist without any change in ferment activity. As a rule there is a certain proportion between the anatomical condition and amount of surviving parenchyma, on the one hand, and the enzyme activity of the external secretion on the other. In cases of primary intralobular pancreatitis, ferment depression is greater than in cases of interlobular inflammation secondary to duct obstruction or inflammation, and Crohn thinks it probable that intralobular pancreatitis is a primary degeneration of the secreting cells.

The metabolism of his 17 cases of pancreatic disease has been studied by Crohn by means of estimating the fat and nitrogen absorption. The diet consisted of 1500 to 2000 c.c. of milk, 3 eggs, 100 grams of bread, 100 to 200 grams of cereal, 50 grams of meat, and normal amounts of water, the whole to be taken in twenty-four hours. This diet has an equivalent of about 120 grams of fat and 15 grams of nitrogen. The absorption test was begun by giving the patient a low saline enema, after which the diet was begun, and the diet and collection of specimens of stool were continued for two days, at the end of which period another enema was given, this stool being added to the stool already collected. The diet and stools were dried and ground in a mortar and pulverized; nitrogen was estimated by the Kjeldahl method, and fat by the Kumagawa-Suto method.

This method of testing pancreatic sufficiency is not comparable in importance to the examination of the duodenal ferments, as roughly speaking, the diminution of ferments is directly proportional to the extent of organic destruction, while the absorption of fat and nitrogen from the intestine is independent of the condition of the external secretion or even of its presence. Absorption may be poor, with an intact gland, or good, with only a fragment of an otherwise diseased gland;

ANALYSIS OF DUODENAL CONTENTS AND DISEASE OF THE PANCREAS.

Case.	Diagnosis.	Duodenal contents.						Absorption tests.				Stool.	
		Jaundice.	Bile.	Ferments.	Amyl-ase, c.c.	Tryp-sin, 1:—	Lip-ase, c.c.	Intake.		Output (stool).		Neutral fat globules.	Undi-gested muscle fiber.
								Fat, gm.	Nitro-gen, gm.	Fat, gm.	Nitrogen, gm.		
1. A. B.	Acute pancreatitis; abscess of tail and body	Slight	+	Very weak	0	0	1.8	101.0	……	9.5 (9.4%)	……	Absent	Absent
2. S. R.	Chronic pancreatitis; intralobular type	Marked	0	Weak	0	6,000	0	71.3	22.18	24.7 (34.7%)	3.6 (16.4%)	Present	Present
3. L. V.	Chronic pancreatitis; intralobular type	Marked	0	Weak	6	700	0	……	……	……	……	Absent	Absent
4. M. W.	Chronic pancreatitis	Moderate	+	Weak	0	3,000	2.7	……	……	……	……	Absent	Absent
5. R. M.	Subacute pancreatitis; cholelithiasis	Absent	++	Weak	0	3,000	0	……	……	……	……	Absent	Absent
6. H. D.	Chronic pancreatitis; cholelithiasis	Moderate	++	Weak	3	1,000	0	……	……	……	……	Absent	Absent
7. R. K.	Hepatic cirrhosis; abdominal adenitis	Moderate	++	Weak	0	5,000	0	118.0	18.0	57.6 (51.3%)	3.4 (18.7%)	Absent	Absent
8. A. B.	Gastric carcinoma; advanced stage	Absent	0	Weak	9	0	1.8	……	……	……	……	Absent	Absent
9. B. S.	Carcinoma of bile duct and liver	Marked	0	Weak	7	2,000	1.4	……	……	……	……	Absent	Absent
10. H. R.	Melanotic sarcomatosis	Absent	++	Weak	0	3,000	2.5	……	……	……	……	Absent	Absent
11. M. F.	Addison's disease	Absent	++	Very weak	0	40	0.6	71.3	……	18.7 (26.2%)	……	Absent	Absent
12. L. J.	Carcinoma of papilla of Vater[1]	Marked	0	Normal	24	30,000	3.3	……	……	……	……	Absent	Absent
13. D. S.	Carcinoma of papilla of Vater[1]	Marked	0	Normal	12	4,300	1.2	……	……	……	……	Absent	Absent
14. A. T.	Chronic pancreatitis; cholelithiasis	Absent	++	Normal	4	10,000	2.1	240.0	30.0	13.8 (5.6%)	1.8 (6.0%)	Absent	Absent
15. T. L.	Tumor of head of pancreas	Slight	+	Normal	24	20,000	1.5	124.0	20.1	35.0 (28.2%)	2.2 (11.0%)	Absent	Absent
16. M. D.	Carcinoma pancreas; obstructed ducts	Intense	0	Absent	0	0	0					Absent	Absent
17. L. K.	Carcinoma pancreas; obstructed ducts	Intense	0	Absent	0	0	0	80.9	11.8	48.4 (60.0%)	1.86 (15.0%)	Present	Present

[1] Intermittent obstruction of pancreatic duct; mild interlobular pancreatitis.

in other words, the functional activity of the gland, not its organic condition, determines the degree of absorption. Duodenal ferment indicates the organic condition of the gland, whereas absorption tests indicate the activity of the pancreas.

In the table on page 121 will be found the summary of Crohn's observations in pancreatic disease.

NUCLEAR DIGESTION IN OCCLUSION OF THE PANCREATIC DUCT. The use of nuclear material in the diagnosis of pancreatic lesions, gained great impetus from the studies of Schmidt and his followers and a clinical method was devised which consisted of feeding of muscle tissue enclosed in silk bags. Later these bags were recovered from the stools, the tissue sectioned, stained, and examined for nuclei. If the nuclei were found to be intact, it was considered evidence that there was pancreatic achylia. Judging the results of various observers from a

ABSORPTION TEST.[1]

Case.	Diagnosis.	Jaundice.	Duodenal contents.		Intake.		Output.	
			Bile.	Ferments.	Fat.	Nitrogen.	Fat.	Nitrogen.
1. A. B.	Acute pancreatitis; abscess	Slight	+	Very weak	101.0	....	9.5 (9.4%)	
	Group 2							
2. S. R.	Chronic pancreatitis, intralobular	Marked	0	Weak	71.3	22.18	24.7 (34.7%)	3.6 (16.4%)
3. A. B.	Chronic pancreatitis, cholelithiasis	Absent	+	Normal	240.0	30.0	13.8 (5.6%)	1.8 (6.0%)
	Group 3							
4. R. K.	Hepatic cirrhosis; abdominal adenitis	Moderate	+	Weak	118.0	18.0	57.6 (51.3%)	3.4 (18.7%)
5. M. F.	Addison's disease	Absent	+	Very weak	71.3	....	18.7 (26.2%)	
	Group 4							
6. M. D.	Carcinoma of pancreas	Intense	0	Absent	124.0	20.1	35.0 (28.2%)	2.2 (11.0%)
7. L. K.	Carcinoma of pancreas	Intense	0	Absent	80.9	11.8	48.4 (60.0%)	1.86 (15.0%)

[1] This table is a rearrangement of the cases in the table on page 121.

purely impartial point of view, it seems that much of the favorable opinion accruing to the test has been achieved by the extremely enthusiastic articles of Schmidt and of his associates directly stimulated by him. On the other hand, much, in fact, all, of the adverse criticism has been leveled by writers outside of Schmidt's influence. It has been found, *in vitro*, and this seems to substantiate Schmidt's work, that neither gastric juice, extract of duodenal mucosa, nor duodenal juice causes any dissolution of nuclear material, whereas pancreatic juice quickly accomplishes the digestion of the nuclei. On the contrary, certain observers, namely, Glaessner and Popper, found readily staining nuclei after attempted digestion with juice obtained from a pancreatic fistula in a girl, and Hesse claims that gastric juice is able to digest nuclei, and that well. My conclusion to date is, that the Schmidt test is fallacious and by no means to be depended upon.

Atchley[1] has had the opportunity to study a man, aged forty-two years, suffering with total occlusion of the pancreatic duct, and has tried to determine in this individual the role the pancreas plays in the digestion of nuclear material. His idea was to feed thymus gland, and by estimating the output of urinary uric acid, to learn the necessity of the pancreas to any stage of nuclear digestion. I reproduce his table:

TABLE SHOWING RESULTS OF EXPERIMENT ON A PURIN-FREE DIET.

Date.		Diet.	Total urine c.c.	Uric acid.
October	27 . .	Purin-free	1565	0.82
	28 . .	Purin-free	1418	0.76
	29 . .	Purin-free	1420	0.76
	30 . .	Purin-free	1380	0.51
	31 . .	Plus 150 grams of thymus	1660	1.32
November	1 . .	Plus 150 grams of thymus	1540	1.25
	2 . .	Purin-free	1485	0.15
	3 . .	Purin-free	1279	0.14

The maximum endogenous output was 0.76 gm. excluding the first day's results, as the level of excretion on the purin-free diet had not been reached at this time. The excess of excretion over the greatest endogenous output on the two thymus days was 0.52 gm. and 0.48 gm. On the principle that 50 per cent. of ingested purin is excreted as urinary uric acid, 150 gms. of thymus should cause approximately 0.6 gm. of uric acid over the endogenous amount. Hence there was in this instance practically a quantitative recovery, demonstrating conclusively that there is digestion of nuclei in the absence of both bile and pancreatic juice. The digestion of nuclear material, according to the work of Atchley, does not depend on pancreatic secretion and indicates to him the worthlessness of the Schmidt nuclei test for pancreatic diseases.

Some time ago I pursued a work along similar lines, studying the output of uric acid, purin bases, and phosphoric acids, after giving nucleic acid by mouth. I subsequently abandoned it on account of the lack of uniformity in my results, and concluded that one could derive but little or no information regarding pancreatic insufficiency from researches based on the study of nuclein digestion.

Diastase in the Feces in Pancreatic Disease. Brown[2] selected diastase as an indicator of pancreatic disease because it is stable, it comes preformed, does not require an activator, and is supplied to the intestine solely by the pancreas. The salivary diastase is eliminated by having the patient take liquid food.

Method. The patient is given a high enema the night before, the evening meal being a very light one. At 7 A.M. the next day, 750 c.c.

[1] Archives of Internal Medicine, 1915, xv, 654.
[2] Johns Hopkins Hospital Bulletin, 1914, xxv, 200.

milk are given, at 7.30 and again at 8, half an ounce of Epsom salts, and at 8.30, a glass of water containing quarter of a teaspoonful of sodium bicarbonate. All the stools up to 2 P.M. were saved in a vessel containing two ounces of toluol, and kept on ice or in a cool room. If less than 400 grams or c.c. of stool were obtained, a pint of warm water by bowel was given.

The stool is to be examined as soon as possible; it is made up to 3000 c.c. with normal salt solution, stirred until absolutely homogeneous, a portion centrifugalized for five minutes and the supernatant fairly clear fluid used for the tests. Diminishing amounts of this fluid were put into a series of tubes, each being brought up to 2 c.c. with normal salt solution. · Thus we have:

1 . . . . 1.8 c.c.	7 . . . . 0.6 c.c.
2 . . . . 1.6 c.c.	8 . . . . 0.4 c.c.
3 . . . . 1.4 c.c.	9 . . . . 0.2 c.c.
4 . . . . 1.2 c.c.	10 . . . . 0.1 c.c.
5 . . . . 1.0 c.c.	11 . . . . 0.05 c.c.
6 . . . . 0.8 c.c.	12 . . . . 0.025 c.c.

To each of these tubes are added 2 c.c. of a 1 per cent. solution of soluble starch (Kahlbaum), the tubes are incubated at 38° C. in a water bath for half an hour, cooled under running water, and tested quickly with a few drops of one-tenth normal iodin solution, the limit being that tube before the one in which the first definite blue color appears.

Extensive carcinoma of the pancreas in Brown's cases showed no diastase in the tube of lowest dilution in his method, and he believes this absence of ferment should prove of great help in diagnosing this condition. In chronic pancreatitis, diastase was present in the stools, but in markedly diminished amounts.

Diastase in the Urine. Normally the amount of diastase varies between 25 and 100 units, but in pancreatic disease, especially necrosis of the pancreas, an excessively large amount is found. So constant is this that Marino[1] claims a diagnosis can be made on this phenomenon alone.

A critical review of the means suggested for the diagnosis of pancreatic disease has been prepared by Hadden[2] because as he writes: "A review of the present state of knowledge of the diagnosis of pancreatic disease is likely to be of use to those who have an interest in the subject, for the volume of work done in this connection in recent years is very large and the great importance of the pancreas in medicine and surgery has become more marked than ever before.

"To summarize the present position of diagnosis of pancreatic disease is not a simple matter. For those who expect an absolute pathognomonic

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[1] Abstract, Journal of American Medical Association, 1914, lxiii, 72.
[2] Quarterly Journal of Medicine, 1913–1914, vii, 455.

sign to be found, the outlook is not encouraging, for it does not seem likely that any one test for pancreatic disease, and that alone, will ever be discovered. The functions of the pancreas are so manifold that only in completely destructive pathological conditions are they all in abeyance. Further, when this is the case some of the functions, especially those subserving digestion, may be more or less effectively performed by other means within the body, and this fact, more perhaps than any other, depreciates very considerably the value of many tests based upon the efficiency of pancreatic ferments. A partial disablement of the gland may, however, cause a diminution in the power of one or more of the ferments in the external secretion, but no reliance can be placed in a quantitative estimation of such ferment action as an index of the degree of pancreatic disease.

"Still more is this so in the case of tests based upon more obscure functions of the pancreas dependent upon its chemical relationships with the rest of the body, for a very small amount of healthy gland tissue can serve to maintain the chemical balance and disguise any process of disease. It is evident also that a complete occlusion of the duct of Wirsung will produce profoundly different changes according as the accessory duct of Santonin is patent or not. Duct occlusion, too, may or may not affect the production of intestinal secretions, at any rate in the earlier stages of such conditions. Nor can the possibility of absorption of ferments be dismissed, and it may well be that our present classification of external and internal secretions of the pancreas may have to be modified, since enzymes of the digestive secretion, *e. g.*, diastase and lipase, can both be demonstrated in the blood serum, and all the evidence points to a pancreatic origin for these ferments in the blood.

"The varying influence of disease processes upon the different parts of the gland have yet to receive a much clearer explanation. The usual classification of pancreatitis is based upon the origin of the inflammatory process, from the bloodvessels, from the ducts and gland acini (ascending infection) or from adjacent viscera, as in cases of duodenal ulceration. Deaver and Pfeiffer, however, have laid stress upon the lymphatic route as an important and frequent mode of infection, and, in the case they described, giving rise to an interlobular pancreatitis. One would expect in an ascending infection a more immediate affect upon the externally secreting cells of the gland, also in an interlobular pancreatitis one would expect the gland acini to have their activity less impaired than in the interacinar variety.

"So far, however, little success has attended attempts to correlate the mode and severity of infection of the pancreas with the chemical signs and symptoms; the data are yet insufficient, and the more immediate problem is not a differential diagnosis of pancreatic lesions, so

much as the answer to the question, Is the pancreas healthy or diseased? This answer is best obtained by calling in the aid of as many witnesses as possible, always remembering that the evidence of any one test may be neglected if at variance with the evidence of the majority, and that in summing up, sight is never lost of the chemical aspects of the case.

"To come to practice, our first question when the pancreas lies under suspicion must be, What kinds of tests can we apply in this instance, simple tests only, or more elaborate methods requiring a well-equipped laboratory and expert assistance? In either instance, as many tests as possible should be made, and if the more elaborate methods are not available, then microscopic examination of the stools for creatorrhea and steatorrhea, and tests for glycosuria, actual or alimentary, should be applied. The adrenalin mydriasis test I should certainly try in every case, although with a healthy skepticism, and finally in most cases it should not be difficult to get the diastase of the urine estimated.

"In the case where a laboratory is at call, that is to say, for patients at either end of the social scale, a more extensive investigation can be tried in addition to the tests already mentioned, and here certainly the urinary diastase should be estimated, and a complete analysis of the fecal fat be made. Metabolism experiments on fat and nitrogen utilization, with and without pancreatic extract, are very desirable, and either the oil-test meal or duodenal intubation may with advantage be tried in suitable cases, together with examination of the diastatic and tryptic power of the feces by the casein method. For the better establishment of their use, rather than for the present value in diagnosis, one would like to see extensively tried the iodin coefficient of Cammidge, and the lecithin content of the stools."

The Pain in Differential Diagnosis of Chronic Disease of the Pancreas. Verloet[1] gives the details of six cases to show that pain is not so rare with chronic pancreatitis as some assert, and that its location is characteristic, as is also its persistency, long duration, and sometimes its severity. Even when there is no spontaneous pain, it may be elicited by pressure. The pain in the lumbar region is most characteristic, but there may be pain in the stomach region and along the median line, and in both flanks, in the left hypochrondrium, the lumbar vertebræ, the upper third of the sacrum, a region a few centimeters wide along and to the left of the lumbar vertebræ, the left arm and hand, the left thigh and the knee, the left scapula and shoulder, the left side of the neck and the ear.

Lithiasis Pancreatica. Based on section material, pancreatic calculi must be a very rare condition. In 1500 autopsies, in the Augusta

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[1] Abstract, Journal of American Medical Association, 1915, lxiv, 2029.

Victoria Hospital, only 1 case was seen; in 2000 necropsies in Königsberg, only 3 cases were encountered in nineteen years. In the Urban Hospital in Berlin, 3018 postmortem examinations were made, 79 cases of pancreatic disease were found but no instance of calculus. Kretz claims that one case occurs in every three thousand sections, and of the cases only about one-third complain of any symptom during life. The first case was mentioned by De Graaf in 1667, and from this time to 1898 only 70 cases are on record.

Rosenthal[1] reports a case found at autopsy which during life had absolutely no symptom of pancreatic stone. The pancreas was found to be very markedly degenerated, and it was a subject of much wonderment to the author to learn that *intra vitam* no symptom of this had been observed, not even glycosuria. Rosenthal makes this case the text of an interesting paper, in which he gives the result of much study, and which is worthy of reprint, owing to the extreme infrequency with which the subject is treated in medical literature.

The condition is oftenest seen in individuals between thirty and fifty years of age, and the great majority of cases are men. In Rosenthal's case, the duct and its branches are filled with calculi, and this seems to be the commonest site. As to the size, this has varied in different cases, one reported weighed 1.2 grams and one was the size of a pea. Kaufmann places the range of size between a grain of sand and a walnut. The surface is either smooth or mulberry-like, generally white or of a brownish tinge. The number of calculi found varies also, in Rosenthal's case twelve large stones were found and innumerable small concrements. There may be but one stone or many, as in this instance. As to the chemical composition of the stones, Rosenthal found the one he reports to have consisted of pure calcium carbonate. In other cases, calcium carbonate, calcium phosphate, and magnesium carbonate have been found. The presence of calcium carbonate indicates that the calculus is not simply the result of pancreatic secretion, as the latter contains practically none of this salt.

As cause for concrement formation it is assumed that there is primarily a catarrhal duodenitis, with ascending inflammation involving the pancreatic ducts and the pancreatic structure in general. Another cause which must be thought of is primary inflammation of the pancreas itself with interference with the secretory activity of the gland.

The symptoms of the affections are variable, and so inconstant that Frerichs was led to assert that the diagnosis of pancreatic calculus is impossible. More lately the question has been studied more thoroughly and much weight is laid on the following symptoms: Severe colic in the epigastrium; later, diabetes, peculiar diarrhea, finding of concrement

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[1] Arch. f. Verdkr., 1914, xx, 619.

in the stools. Albu writes as follows: "When a stone leaves the pancreatic duct, then for the first time there appears severe colic, resembling closely biliary or renal colic. Of importance, at times, from a differential diagnostic standpoint are the following points. (1) Between attacks, there exists dull aching in the epigastrium without icterus. When the latter appears, emaciation is seen, both being an indication that there is compression of the common duct either by the indented head of the pancreas or by the stone itself. (2) The attacks of pain are accompanied by profuse vomiting associated with nausea, and begin in the umbilical region, radiating from there to the left hypochondrium and to the left shoulder, rarely to the right shoulder. (3) Detection of a painful resistance in the pancreatic region, this area of resistance seeming to 'swell' periodically with the attacks of pain. (4) The complication of diabetes, which in no pancreatic disease is so frequent as in stone (45 per cent.) or the presence of alimentary glycosuria, following the attacks of pain. (5) The rare phenomenon of steatorrhea, which is of importance only in the absence of icterus. (6) The rare finding of calculi in the feces, a finding reported but twice in the literature. In these cases the stones may be confused with biliary calculi, but the former contains less lime, no bilirubin, no radiation on cutting, and no facet formation. (7) In a few cases salivation is seen at the time of the attacks."

Cysts in the Pancreas. In one of Ipsen's[1] six cases, a trauma seems to have been responsible for the development of the cysts. The first symptoms of trouble were apparent ten days later. When the pancreas is injured in an accident, acute inflammation follows if the trauma was severe and much pancreatic juice was forced out, while there may be merely production of a cyst if the injury was comparatively slight. In another of his cases, the cyst was probably secondary to the cancer found with it, the cancer having injured the tissue like a trauma. The four other patients had long had recurring attacks of pain, and gallstones were found at necropsy in two cases. These were probably the cause of the attacks of pain, and the passage of the stone may finally have stretched the opening leading up into the pancreas with resulting destruction of pancreas tissue and cyst formation.

In the other cases the attacks of pain and occasionally transient jaundice suggest gall-stones. The pains were always located on the left side; however, in one case the symptoms seemed to suggest perforation of a gastric ulcer or peritonitis, but the signs of pleuritis and transient albuminuria did not agree with this, and x-ray examination revealed an accumulation of fluid just below the diaphragm on the left side. Treatment is always surgical.

[1] Abstract, Journal of American Medical Association, 1914, lxiii, 1146.

Pancreatic Infantilism. Under this name, Bramwell[1] describes cases of arrested bodily and sexual development, with chronic diarrhea, flatulent distention of the abdomen, and defective or arrested pancreatic secretion. The latter, he says, is probably due to chronic pancreatitis and is completely cured by the administration of pancreatic extract alone. In Bramwell's article are illustrations showing the cases "before" and "after" treatment, the individuals exhibiting remarkable improvement. The pancreatic extract used was Armour's liquor pancreaticus, teaspoonful three times a day. These cases of Bramwell's suggest somewhat those of gastrogenous diarrhea, of which so much is being written, and which I have discussed elsewhere in this number of PROGRESSIVE MEDICINE.

[1] Edinburgh Medical Journal, 1915, N. S., xiv, 323.
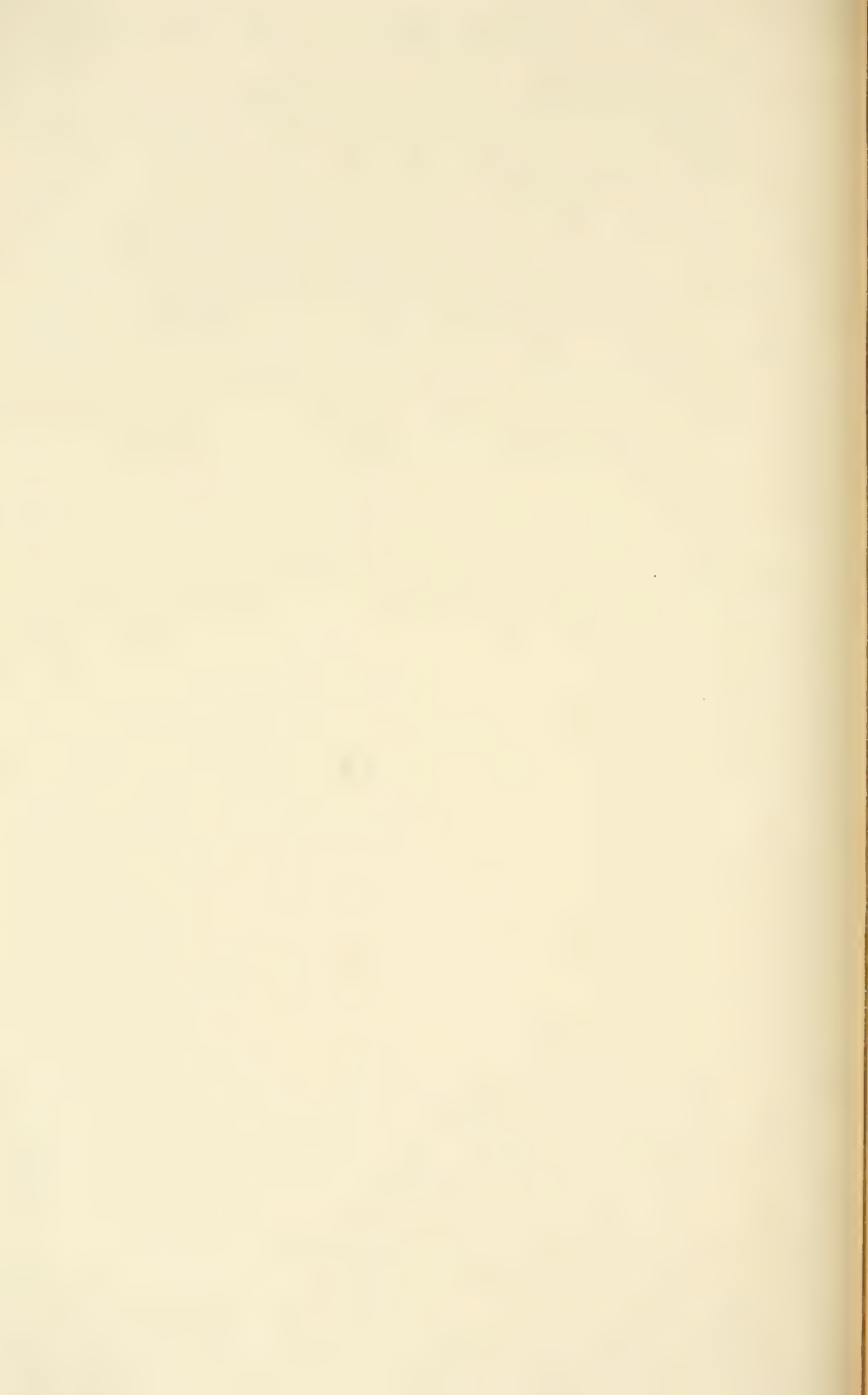
DISEASES OF THE KIDNEYS.

By J. HAROLD AUSTIN, M.D.

PROBABLY the most striking feature in the study of diseases of the kidney during the past year is the large number of investigations, for the most part clinical, but in some instances experimental, that have aimed at correlating with the clinical symptoms and postmortem findings, one, or more often several, of the renal functional tests. As the result of these investigations our classification of nephritis has been rendered more precise and the value of the various functional tests has become more clearly defined.

It seems desirable, therefore, first to discuss briefly the significance of each of the more thoroughly studied functional tests and then to give a brief outline of the characteristic features of the various types of nephritis as classified, in part at least, by the aid of these tests.

The detailed technique of the tests will not be given, but, instead, references to sources from which this may be obtained.

Blood-pressure. In a new monograph by Volhard and Fahr,[1] there is given an admirable summary of our knowledge concerning the *relation of elevation of blood-pressure to renal disease.* These authors emphasize, in the first place, the association of elevation of blood-pressure with diffuse glomerulonephritis, whether this be in the acute, chronic or terminal stage. They note that acute or chronic degenerative changes in the epithelium of the renal tubules without glomerular lesions, in other words, simple degenerative nephritis (or nephropathy) as distinguished from diffuse glomerulonephritis, is without elevation of blood-pressure, and that elevation of blood-pressure constitutes the most reliable means of distinguishing between this simple degenerative nephritis and diffuse glomerulonephritis. They have also emphasized the fact that there exists a stage of glomerulonephritis between the acute and the terminal stages in which a tendency to elevation of blood-pressure, with more or less albuminuria and casts, is often the only evidence of renal disease, all the other renal functional tests in this stage being quite normal. This is a point of great practical importance.

In the second place, they have studied that form of arteriosclerosis characterized by thickening of the intima of the smallest renal vessels, but without any changes in the great majority of the glomeruli and with but little change in the tubules; this they call simple, or benign, sclerosis.

[1] Die Brightsche Nierenkrankeit, Volhard and Fahr, Berlin, 1914.

It is characterized during life by extremely high blood-pressure, including indeed some of the highest pressures ever observed, but, while cardiac compensation is good, there is no disturbance of the other renal functional tests and the urine is either normal or, at most, contains an occasional trace of albumin and occasional hyaline or granular casts. This disease is very benign and may last for thirty years, with little detriment to the patient. It is essentially the form of primary vascular disease described by Gull and Sutton, by Löhlein and by Jores, and the primarily cardiovascular nature of its clinical manifestations has been emphasized by Janeway[1] and by Stengel.[2] The especial contribution of Volhard and Fahr is to call attention to the freedom of most of the glomeruli from lesions in these benign cases, and to this fact they attribute the normal renal function. Volhard and Fahr note further, however, that a small proportion (probably about 10 to 15 per cent.) of individuals with this simple, benign hypertension insidiously develop evidences of renal insufficiency. The first indication of this transition varies in different cases; it may be albuminuric retinitis, or falling phthalein, or increasing non-protein or urea blood-nitrogen or a tendency to polyuria with fixation of the specific gravity. Gradually the evidences of renal insufficiency include all, or most, of the above-named, and the symptoms of uremia, the usual termination, appear. Histologically, Volhard and Fahr find that these kidneys differ from those of simple, benign sclerosis in that a larger proportion of the glomeruli are seriously diseased or completely obliterated. Sometimes, histologically, but more surely by the character of the clinical course, they believe these cases may be distinguished from the somewhat similar terminal stage of glomerulonephritis (secondarily contracted kidney). They consider that these cases represent an arteriosclerotic nephritis or "*Kombinationsform*," a primary sclerosis with secondary glomerular lesions and consequent renal insufficiency. A further discussion of these types of renal disease will be given later.

The Water Test, Dilution and Concentration Tests. The ability of the kidney to eliminate water normally may be tested both by the time required to eliminate a large water intake and by the specific gravity of the urine at the height of this elimination. After ingestion of from 1500 to 2000 c.c. of water in from one-half to one hour, the normal kidney can eliminate 500 c.c. in a half-hour (Volhard and Fahr) and the two liters, in addition to the ordinary urine output, should be completely eliminated within twenty-four hours. While the water-eliminating function of the kidney may be much depressed by passive congestion, by acute glomerulonephritis or by simple degenerative nephritis, it often remains little impaired until the very latest stages of chronic glomerulonephritis or arteriosclerotic nephritis, being apparently normal

[1] Archives of Internal Medicine, 1913, xii, 755.
[2] Journal of American Medical Association, 1914, lxiii, 1463.

long after the other renal functional tests show extreme impairment and when uremia is imminent. The amount of urine eliminated by the kidney is subject, to a very great degree, to extrarenal influences, sweating, diarrhea, dryness of the atmosphere, etc., and this fact must be kept in mind in interpreting the results of any water test.

In the variations of the urinary specific gravity we have also a test of value. After twenty-four hours upon a very dry diet, the urinary specific gravity rises normally to a high figure, often over 1.030. As the power of the kidney to eliminate solids becomes impaired, however, the capacity of secreting a urine of high specific gravity is lost, so that eventually the diseased kidney can not, even on a dry regime, excrete urine above a specific gravity of about 1.013. Under such circumstances a demand for increased elimination of solids is met by polyuria without increase of the concentration of the solids or of the specific gravity; hence the polyuria of the later stages of glomerulonephritis and arteriosclerotic nephritis (Kombinationsform). The kidney has lost the ability to concentrate and there is said to exist a hyposthenuria (urine of low specific gravity). Temporary hyposthenuria may arise from extrarenal causes, as, for instance, after excessive water intake, during the reduction of an edema, or following a brief period of water retention, such as may occur at the onset of a mild nephritis; such hyposthenuria is obviously not an evidence of renal impairment. When, however, the urine remains persistently of low specific gravity in spite of a dry diet, some degree of renal insufficiency may be properly assumed to be present.

After the ability to concentrate the urine is lost, the kidney may still preserve its normal power of diluting the urine, so that after the ingestion of a large amount of distilled water (1500 to 2000 c.c.) the urinary specific gravity may fall to 1.005 or less (Volhard and Fahr). Eventually, however, with progressing renal disease, even this capacity for varying the urinary composition is destroyed and the kidney excretes only a urine of fixed specific gravity (1.011 to 1.013) and of relatively fixed composition.

The concentration and dilution tests, certainly the simplest of all renal functional tests are of very considerable value provided the existence of extrarenal causes for hyposthenuria be kept in mind and excluded.

Chloride Elimination. Normally, a dose of ten grams of sodium chloride added to a standard daily intake is completely eliminated with the usual daily quota within twenty-four hours. Delayed elimination of chlorides is often the earliest evidence of impaired renal function. It may be observed in renal congestion and in practically all forms of nephritis, except in those with polyuria, when it is rare. In experimental nephritis induced by chrome salts or mercuric chloride, v. Monakow[1]

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[1] Deut. Archiv f. klin. Med., 1914, cxv, 47, 224; cxvi, 127.

has shown that chloride elimination is more quickly impaired than is the urea elimination, and Austin and Eisenbrey[1] found the same to be true in uranium nephritis. Frothingham[2] has found delayed chloride elimination most useful as an early indication of renal impairment in human nephritis, although it must be remembered that certain extra-renal factors may cause chloride retention, especially the formation of exudates, as in lobar pneumonia, or the development of cardiac edema.

Regarding the *concentration of chlorides* in the urine, Volhard and Fahr find that, with the normal kidney, they may, under favorable conditions, reach about 1.8 per cent. The diseased kidney, on the other hand, may be incapable of concentrating the chlorides in the urine above 0.5 to 0.3 per cent. or less, even when the chloride intake has been large and the water intake small.

V. Monakow discusses the *relation of chloride retention to edema*. From his observations, he confirms the finding of many others, namely, that while chloride retention and edema are usually associated, either may occur without the other. When chloride retention is associated with edema, he finds associated retention of water in about the proportions of physiological saline. In these cases, v. Monakow suggests that the retention is an intercellular one. On the other hand, when chloride retention occurs without edema, there is no associated retention of water, and v. Monakow suggests that this may be an intracellular retention.

For the *estimation of urinary chlorides*, McLean[3] advises the use of a modification of the Volhard method in which the excess silver is titrated with ammonium sulphocyanide without filtering off the precipitate of silver chloride, but in the presence of 5 per cent. nitric acid and after allowing five minutes for the complete precipitation of the chlorides. That removal of the proteins is unnecessary was shown by Bayne Jones.[4]

Chlorides of the Blood. In a series of 68 cases to which they applied the Ambard formulas, Bauer and Nyiri[5] studied the sodium chloride concentration of the blood and found it, in normal cases, to be from about 5.6 to 6.1 gms. per liter. McLean, in 65 observations, obtained figures as a rule between 5.62 and 6.25; if excessive quantities of chlorides were ingested, the figure was somewhat higher. In certain nephritic cases, Bauer and Nyiri found concentrations to about 7.1 gms. per liter, the highest occurring usually in nephritis with edema. Rarely did they note a high chloride concentration persisting for a long time. In passive congestion, the chlorides of the

[1] Journal of Experimental Medicine, 1911, xiv, 366.
[2] American Journal of Medical Sciences, 1915, cxlix, 808.
[3] Journal of Experimental Medicine, 1915, xxii, 212.
[4] Archives of Internal Medicine, 1913, xii, 90.
[5] Ztschr. f. Urologie, 1915, ix, 81.

serum were, as a rule, normal. In some instances they observed increased chlorides in the serum during periods when the chloride balance was normal.

McLean and Van Slyke[1] have published a new method for estimating the chlorides of the blood or other body fluids which requires only 1 or 2 c.c. of oxalated plasma or other fluid.

In the retention of chlorides, whether shown by the comparison of intake and output, or by the estimation of the chlorides of the blood, we have a method of value especially for the early detection of slight grades of renal insufficiency. Particular care must be taken, however, not to overlook extrarenal causes of chloride retention.

Nitrogen Elimination. The nitrogen eliminating function of the kidney may be tested by noting the promptness with which a dose of urea (about 15 grams, which contains 7 grams of nitrogen), added to a standard diet, is eliminated. The total nitrogen of the twenty-four-hour urine may be estimated by the Kjeldahl or by the Folin method, or rather more easily the urea may be estimated by the urease method. Normally, such an added dose of urea should be approximately eliminated in twenty-four hours. Delayed nitrogen elimination is observed in glomerulonephritis in the acute stage and again in the terminal stage, also in arteriosclerotic nephritis (Volhard and Fahr), but not in simple sclerosis (benign form without renal insufficiency) nor, as a rule, in passive congestion nor in degenerative tubular nephritis. An exception occurs in the case of bichlorde of mercury poisoning, which is, as a rule, a degenerative or necrotic tubular nephritis with little or no glomerular involvement. It is not infrequently characterized, however, by anuria or extreme oliguria and under such conditions nitrogen elimination is impaired. Even in cases with approximately normal output of urine, the nitrogen elimination may be impaired, as demonstrated by a case of Foster's[2] in which, while the urinary output remained normal, the non-protein blood-nitrogen rose to from 209 to 238 mgms. per 100 c.c.; at autopsy, the tubules showed extensive degeneration and necrosis, but the glomeruli were almost normal. This case argues against the view of certain observers who hold that the excretion of nitrogen is a glomerular function. It must be remembered that, as in the case of water and chlorides, extrarenal factors may influence markedly the nitrogen output. Thus, in a very mild experimental uranium nephritis, Austin and Eisenbrey[3] showed that the nitrogen output might be in excess of the intake; recently, Mosenthal[4] has confirmed this finding and has shown that it is due to the increased tissue catabolism resulting from the poison.

[1] Journal of Biological Chemistry, 1915, xxi, 361.
[2] Archives of Internal Medicine, 1915, xv, 754
[3] Loc. cit.
[4] Archives of Internal Medicine, 1914, xiv, 844.

Non-protein and Urea Blood-nitrogen (Rest-nitrogen). Most easily interpreted and usually of greater diagnostic and prognostic value than the estimation of the nitrogen excretion in the urine is the estimation of the non-protein nitrogen or the urea-nitrogen of the blood. In this country, the Folin method for the non-protein nitrogen[1] and Marshall's urease method for the urea-nitrogen, or its modification by Van Slyke and Cullen,[2] are those chiefly employed, the latter being probably the simplest.

A modification of the Folin method has just been devised by Taylor and Hulton[3] which requires only a few drops of blood from the finger for the analysis. It gives results accurate within 3 to 5 mgms. per 100 c.c. This method should render possible the study of the blood-nitrogen at frequent intervals to an extent that has not previously been possible.

The non-protein blood-nitrogen in normal individuals ranges from about 22 to 30 mgms. per 100 c.c. of blood. Tileston and Comfort[4] find values in fasting normal individuals between 22.9 and 25 mgms., and, after a full meal of meat, a rise which in a series of normal individuals averaged 4.7 mgms. Studying the effect of feeding upon the non-protein blood-nitrogen of the dog, Pepper and Austin[5] found a rise of 9 mgms. after an ordinary meat feeding, the maximum being reached in two hours, and a rise of 25 to 40 mgms., after an excessive meat feeding, the maximum being reached only after six to eight hours.

The urea-nitrogen constitutes, normally, from about 30 to 50 per cent. of the non-protein blood-nitrogen. McLean finds it, in a series of normal individuals, varying from 9 to 25 mgms, per 100 c.c. (0.2 to 0.5 grams of urea per liter, since 60 grams of urea contain 28 grams of nitrogen). Tileston and Comfort, in fasting normal individuals, found the urea-nitrogen between 12 and 14 mgms. per 100 c.c.

Of the other constituents of the non-protein-nitrogen, Folin and Denis[6] have found the uric acid-nitrogen to be, in normal individuals, 0.3 to 1 gm. per 100 c.c. (0.9 to 3 gms. uric acid), the creatinine-nitrogen 0.4 to 0.5 mgms. (1 to 1.4 mgms. creatinine) and the creatine-nitrogen 1.6 to 2.7 mgms. (5 to 8.4 mgms. creatine). Van Slyke and Meyer[7] found the amino-nitrogen in the fasting dog to be quite constantly from 3 to 8 mgms. per 100 c.c. and to rise but little, even after feeding. The ammonia-nitrogen of normal blood is seldom, according to Foster,[8] above 0.5 mgms. per 100 c.c.

Increase in the non-protein blood-nitrogen occurs in the same types of nephritis already noted as characterized by impaired nitrogen elimina-

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[1] Journal of Biological Chemistry, 1912, xi, 527.
[2] Ibid., 1915, xix, 211.   [3] Ibid., xxii, 63.
[4] Archives of Internal Medicine, 1914, xiv, 620.
[5] Journal of Biological Chemistry, 1915, xxii, 81.
[6] Ibid., 1913, xvi, 29; 1914, xvii, 487.
[7] Ibid., 1912, xii, 399; 1913–1914, xvi, 197.
[8] Archives of Internal Medicine, 1915, xv, 356.

tion, namely, in the acute and the final stage of glomerulonephritis, in the late stages of arteriosclerotic nephritis and in at least certain cases of severe degenerative tubular nephritis, such as some cases of bichloride of mercury poisoning. The non-protein blood-nitrogen rises in such cases in proportion to the impairment of renal function, and, to a lesser degree, in proportion to the amount of protein in the diet. In the severe cases it often exceeds 100 mgms. per 100 c.c., or occasionally may be over 200 mgms. Frothingham and Smillie[1] studied the effects of varying the protein content of the diet in nephritis and found that the non-protein blood-nitrogen was, as a rule, increased upon increasing the nitrogen content of the diet, and *vice versa*, although some exceptions to the rule were observed. The greatest variations resulting from alteration in diet were about 25 mgms. per 100 c.c. Hopkins and Jonas,[2] in a similar study, found that varying the diet from 5 gms. up to 18 gms. of nitrogen (30 to 110 gms. protein) per day caused an increase in the non-protein blood-nitrogen of nephritics of from 3 to 26 mgms. per 100 c.c. That a considerable increase in the blood-nitrogen may be produced by chronic passive congestion and cyanotic induration of the kidney without true nephritis is demonstrated by four cases, with autopsy, reported by Foster[3] in which the non-protein blood-nitrogen ranged from 40 to 90 mgms. The non-protein blood-nitrogen, however, is less influenced by passive congestion than is the phthalein test.

When the non-protein blood-nitrogen is increased, this is, as a rule, due chiefly to the urea-nitrogen which in these cases may constitute 70 to 90 per cent. of the non-protein nitrogen. Meyers and Fine[4] have shown, however, a striking increase also in the other components. Thus the uric acid-nitrogen may rise to 9 mgms. (27 mgms. uric acid) and the creatinine-nitrogen to 12.4 mgms. (33.3 mgms. creatinine). Folin[5] has shown that while the uric acid and creatine of the blood may be increased in a variety of extrarenal diseases, the creatinine is increased only in renal disease. Foster[6] found the purin-nitrogen of his uremic cases averaging 12 mgms., the highest being 16, and observed no relation between the amount of this component and the amount of total non-protein-nitrogen. Combined creatine-creatinine-nitrogen ranged, in four uremic cases, from 27 to 46 mgms. Neubauer[7] has advocated the use of creatinine as a test of renal efficiency. He gives 1.5 gms. of creatinine in sweetened water by mouth. This is normally completely excreted in twenty-four hours in addition to the normal creatinine output. Delayed excretion is, in his experience, an early and delicate sign of renal impairment. That this test may not be devoid of danger is

[1] Archives of Internal Medicine, 1915, xv, 204.
[2] Ibid., 964.   [3] Loc. cit.
[4] Journal of Biological Chemistry, 1915, xx, 391.
[5] Loc. cit.   [6] Loc. cit.
[7] Münch. med. Woch., 1914, lxi, 857.

suggested by the findings of Kraus[1] who observed that the injection of creatinine into dogs with acute uranium nephritis leads to decreased output of creatinine, uric acid, chlorides and water, and sometimes is followed by death; this does not occur in mild or subacute forms of uranium nephritis. Foster[2] has found the ammonia-nitrogen of the blood in 28 uremics to range from within normal limits to as high as 2.2 mgms. per 100 c.c., the highest values occurring in cases of the convulsive type. The amount of this component tends to follow the total non-protein-nitrogen. The amino-acid content of his uremic cases was normal.

Increase of the non-protein-nitrogen and of the urea of the blood appears to be closely associated with a tendency to *uremia*. Indeed, most cases of uremia exhibit a very marked increase of these substances, the non-protein-nitrogen being usually above 100 mgms. per 100 c.c. and not infrequently above 200. However, some cases occur with marked increase of these substances and no evidence of uremia, and, conversely, convulsive seizures, otherwise indistinguishable from uremia, may develop in nephritis with little or no elevation of the non-protein blood-nitrogen or urea. Widal, Strauss, and others, who consider that there is an essential relationship between increase of the non-protein-nitrogen of the blood (azotemia) and true uremia have applied the term eclamptic pseudouremia to attacks resembling uremia but with normal or nearly normal non-protein blood-nitrogen. These attacks they attribute to spasm of the cerebral vessels, to cerebral sclerosis, or to edema of the brain, and they believe that they differ from true uremia in the promptness and completeness of recovery and in the absence of a uremic odor on the breath. They claim for these attacks a less serious prognostic significance than for true uremic seizures. Whether this distinction is justifiable can not as yet be settled.

Foster[3] has found that the convulsive types of uremia tend to exhibit a somewhat higher non-protein-nitrogen than the asthenic types. He is unwilling to attribute any prognostic value to the amount of non-protein blood-nitrogen in uremic cases, for, of his 26 uremic cases, 23 died within six months although the blood-nitrogen in the various cases had ranged from 239 mgms. to as low as 40 mgms.

In chronic renal disease, considerable prognostic value can be attached to a persistently very high non-protein blood-nitrogen; for example, above 80 to 100 mgms. Such a finding, especially if accompanied by a low phthalein output, fixation of the specific gravity and perhaps albuminuric retinitis, indicates that renal function is seriously damaged, that there is constant danger of uremia, and that a long tenure of life cannot be expected. On the other hand, in acute nephritis, or in the acute exacerbations that frequently characterize a

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[1] Archives of Internal Medicine, 1913, xi, 613.
[2] Loc. cit.   [3] Loc. cit.

chronic nephritis, very high values, such as 180 mgms. or more, may exist for a few days, but with prompt return to normal or nearly normal with the subsidence of the acute conditions, and in chronic nephritis a value but little above normal does not exclude an early fatal issue with uremia.

That a retention of nitrogen, shown by a comparison of output with intake, may exist without a commensurate increase in the non-protein blood-nitrogen has led v. Monakow to conclude that there can be a tissue retention of urea out of proportion to that accumulated in the blood. The extremely rapid rises of the non-protein blood-nitrogen sometimes observed just before death or with the onset of uremia, he believes, may, at times, be due to the sudden liberation into the blood of such tissue-retained urea. Probably more frequently this phenomenon is to be attributed to a rapid tissue catabolism of toxic origin. Marshall and Davis[1] have found that, in the normal dog, urea injected intravenously rapidly distributes itself almost uniformly between the blood and the tissues.

Strauss finds that certain extrarenal causes, such as fevers, the coma of diabetes or advanced cancer, and leukemia, give rise to a very moderate increase of the non-protein blood-nitrogen; all of the conditions he mentions are accompanied, it will be noted, by a rapid tissue catabolism.

In the estimation of the non-protein or urea blood-nitrogen, we possess probably the most valuable indicator of serious renal insufficiency.

Ambard's Coefficient. Ambard has stated that when the kidney is normal the rate of urea excretion is determined by the concentration of urea in the blood and by the rate of water excretion, and that this relation may be expressed by a formula containing a constant which is approximately the same for all normal persons and for the same person at different times. This formula, as simplified by McLean, is as follows:

$$\frac{U}{\sqrt{\frac{D}{Wt.}} \; \sqrt{C}} = K$$

In which

U = grams of urea per liter of blood.

D = grams of urea excreted, calculated for twenty-four hours (usually actually measured for seventy-two minutes).

C = grams of urea per liter of urine (during period of observation, usually seventy-two minutes).

$Wt.$ = body weight in kilos.

K = the constant.

[1] Journal of Biological Chemistry, 1914, xviii, 53.

The method, in brief, consists in carefully collecting all the urine execreted during a period of seventy-two minutes ($\frac{1}{20}$ of twenty-four hours), noting its amount and determining its content of urea; from these data D and C are obtained. At exactly the mid-point of the seventy-two-minute period, blood is drawn from a vein, and its urea content determined to obtain U.

McLean, in a series of observations on normal cases, has found this constant (K) to vary from 0.19 to 0.36, the average value being 0.3. Impaired renal function causes an increase in the value of K. Bauer, who has applied this method (using Ambard's original formula, which, while the same in principle, gives a constant of different value) to 68 cases, has found a close correlation between increase in K and clinical evidences of impaired renal function.

To simplify the rather complicated calculation from the data when obtained, McLean has modified Ambard's formula to the following:

$$\frac{D \ \sqrt{C} \times 8.96}{Wt. \times U^2} = I$$

and has constructed a slide rule upon which, with two settings, I may be read directly from the data D, C, $Wt.$ and U. I is an index of renal function which takes the place of the constant K in the original formula, but which falls, instead of rising, with impaired renal function. In McLean's series, this index I ranges in normal individuals from 80 to 220, but, with impaired renal function for nitrogen elimination, tends to fall below 80.

Ambard also applied his principle to chlorides, as follows: The rate of sodium chloride excretion is dependent upon the excess of sodium chloride in the plasma above a certain threshold (in normal individuals about 5.62 gms. per liter of plasma) and upon the rate of water excretion. This law is expressed by McLean as follows:

$$N - \sqrt{\frac{D \ \sqrt{C}}{Wt. \times 4.23}} = T$$

In which

N = grams of sodium chloride per liter of plasma.
D = grams of sodium chloride excreted, calculated for twenty-four hours (usually actually measured for seventy-two minutes).
C = grams of sodium chloride per liter of urine (during period of observation, usually seventy-two minutes).
$Wt.$ = body weight in kilos.
T = the threshold.

T was found by McLean to vary in 65 observations on normal individuals from 5.24 to 5.84 grams per liter, but in 90 per cent. of his

observations to lie between 5.52 and 5.67. Impairment of the renal function for eliminating chlorides should cause T to rise. McLean's slide rule, mentioned above, is also constructed for making this calculation.

Whether Ambard's formulas (either in their original form or as modified by McLean) will prove of greater practical value for testing the nitrogen and chloride-eliminating functions of the kidney than the simple estimation of the non-protein-nitrogen or urea of the blood and the chloride content of the plasma, can only be settled after further comparative studies of the methods. The considerable variations that, under certain conditions, are found in normal individuals by McLean, using the Ambard method, would lead one rather to await the further demonstration of the special value of this more complicated method.

Lactose Test. The lactose test, put forward by Schlayer and his associates as a test of glomerular function, has not found favor. It is a cumbersome test, since the lactose must be injected intravenously, and, as boiling to some extent decomposes the lactose, it must be rendered sterile by pasteurization on four successive days. Occasionally its administration is followed by a chill. Rowntree and Fitz[1] describe the technique in detail. They found that lactose excretion is impaired in most renal diseases, even in simple passive congestion, and suggest that it may be rather too sensitive a test to be of great clinical value. It is worthy of note that Schlayer has reported no case, in which the lactose test was normal when the iodide test was impaired, the finding that, according to Schlayer's hypothesis, should exist in a purely tubular nephritis, and in view of the known existence of degenerative nephropathies involving the tubules and with practically normal glomeruli, this fact would seem to argue against the view that lactose is a test exclusively of glomerular function.

Volhard and Fahr find that, after the cessation of the acute symptoms of an acute glomerulonephritis and before the development of the renal insufficiency which characterizes the final stage of these cases (secondarily contracted kidney), there may not infrequently be observed a period which they call the second, or early chronic stage of glomerulonephritis in which persistent presence of albumin and casts in the urine and a persistent elevation of blood-pressure constitute the only evidences of renal disease. A few such cases, coming to autopsy through some intercurrent disease, exhibit, as the most conspicuous renal change, a chronic glomerular lesion. Yet these cases frequently exhibit an entirely normal lactose elimination. The lactose elimination is impaired, however, if cardiac weakness supervenes and also when the condition progresses to the final stage. They also note that, in acute and subacute forms of nephritis, the lactose test is more impaired in cases

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[1] Archives of Internal Medicine, 1913, xi, 258.

with edema, a symptom which histological studies appear to correlate rather with degenerative tubular lesions than with glomerular changes. They can obtain no aid from the lactose test in differentiating glomerulonephritis, simple degenerative tubular nephritis, and simple renal sclerosis. Indeed, an impairment of lactose excretion has been noted by them at times in acute infections without other evidence of renal involvement. Toward the close of an acute glomerulonephritis, they find that the lactose test affords no aid in predicting a tendency to recurrences. Finally, in some cases of acute nephritis an increase in the hematuria has been noted after the lactose injection, suggesting that the sugar may act as a renal irritant.

V. Monakow injected lactose twenty-three times into normal individuals; in 10 instances the elimination persisted for four to five hours; in 13 from six to seven hours. Hence, he concludes that seven hours must be considered the upper limit of normality. Like Volhard and Fahr, he finds no constant relation between the impairment in lactose elimination and either the type or the severity of the nephritis. He has observed only a slight impairment of lactose excretion in a severe case of chronic nephritis just before exitus. In another case, the lactose excretion became distinctly poorer as the patient clinically improved. Finally, he notes that elderly persons who show no elevation of blood-pressure or other evidences of renal impairment frequently show impaired lactose elimination. Similar findings tending to discount the value of the test, from the clinical standpoint, are reported by Bosle[1] in a study of renal function in children.

In an experimental study of tartrate nephritis, a nephritis which with moderate dosage of the poison is almost a pure tubular nephritis, Potter and Bell[2] found such a marked reduction in the lactose elimination as to lead them to conclude that it is eliminated chiefly by the tubules, although possibly to a lesser degree by the glomeruli also.

It would seem, therefore, that proof is as yet lacking that lactose is an indicator of glomerular function, that it may be a misleading test when attempting to recognize slight or early renal lesions, that it affords less reliable conclusions as to prognosis than do other tests, and that a classification of nephritis based upon this test does not agree with that based upon other clinical, functional, and histological studies.

Potassium Iodide as an Indicator of Renal Tubular Function. Potassium iodide was put forward by Schlayer as an indicator of tubular function. After giving 0.5 to 1 gm. by mouth, the drug can be detected in the urine normally for from forty-eight to sixty hours, during which time from 70 to 90 per cent. of the amount given is eliminated. With diseased kidneys, the drug is present for more than sixty hours, sometimes for more than one hundred hours. While apparently the elimination

[1] Ztsch. f. Kinderheilkunde, 1914, xi, 346.
[2] American Journal of Medical Sciences, 1915, cxlix, 236.

of this drug is a measure of tubular activity, the test has been abandoned by most investigators in favor of the phthalein test, which, in a general way, it parallels. The phthalein test has the great advantage of being completed in two hours and has, moreover, proved more reliable.

Phthalein Test.[1] From many sources in this country and in Europe come reports confirming the value of this test which has the further recommendation that it is one of the simplest of renal tests.

In *passive congestion of the kidney*, the phthalein output is usually reduced, and, in cases of marked cardiac decompensation, it may be only a mere trace but characteristically exhibits a rapid rise upon improvement in the circulatory condition.

In *degenerative nephritis*, the phthalein test is very variable. Several cases have been reported with marked albuminuria, casts, and some disturbance of chloride elimination, yet with normal phthalein elimination or even an output above the normal. More frequently there is a reduction of phthalein output, and this may be very marked, as in one case of amyloid kidney in Thayer's and Snowden's[2] series.

In *acute glomerulonephritis*, the phthalein may be only moderately reduced or its elimination may be zero. Probably no prognostic import is to be attached to the degree of its depression in this condition; thus, Tileston and Comfort[3] report a case of acute nephritis with zero phthalein which recovered, and Freeman reports a child with only 3 per cent. elimination and complete recovery.

In *chronic glomerulonephritis*, reference has already been made to the intermediate (second) stage noted by Volhard and Fahr, in which, with albuminuria, casts and elevation of blood-pressure, the renal functional tests are normal; the phthalein test is no exception to this rule. As the case progresses, however, the phthalein gradually falls, indicating transition to the third stage; eventually, the phthalein excretion is reduced to a mere trace or to zero. This minimal point was reached in Thayer's and Snowden's cases from a month to a day before death. The test is of great value in this condition, affording one of the best criteria of the remaining functional capacity of the kidneys, often giving a timely warning of impending uremia and serving as a useful guide in prognosis; this value it shares with the estimation of the non-protein-nitrogen or urea of the blood.

In simple, *benign sclerosis*, unless there be cardiac decompensation, the phthalein is, as a rule, quite normal or often above normal (Stengel). It serves, therefore, to differentiate these cases of good prognosis, not demanding specific renal therapy, from other forms of arterial hypertension—the third stage of glomerulonephritis and the arteriosclerotic

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[1] Archives of Internal Medicine., 1912, ix, 284.

[2] American Journal of Medical Sciences, 1914, cxlviii, 781.

[3] Proceedings of American Pediatric Society, Journal of American Medical Association, 1915, lxiv, 2094.

nephritis ("Kombinationsform" of Volhard and Fahr). When a transition occurs from simple sclerosis to the arteriosclerotic nephritis, Volhard and Fahr have noted an associated impairment of the renal functional tests, and the writer has observed in such cases that falling phthalein elimination may be one of the first indications of the transition. In the fully developed arteriosclerotic nephritis, the phthalein may reach a very low point, although rarely quite the minimal point observed in the third stage of glomerulonephritis (secondarily contracted kidney). V. Monakow has summed up the uses of the test as follows:

A marked diminution of the phthalein test is an indication of severe loss of renal function. On the other hand, a normal phthalein does not exclude renal disease. It cannot be used to exclude a very early nephritis nor the persistence of some chronic renal injury following an acute nephritis, for in these conditions it may be quite normal. Changes upward or downward in the phthalein test have a prognostic value. In any severe disorder, such as coma or a convulsive seizure, a normal phthalein usually excludes true uremia, whereas a greatly reduced phthalein renders it extremely probable that the condition is of renal origin.

Rowntree, Marshall and Baetjer[1] have suggested that whenever the phthalein test is even slightly depressed, the non-protein-nitrogen or urea of the blood should be estimated. This aids in excluding those cases in which phthalein output is depressed by passive congestion, since the non-protein or urea blood-nitrogen is less affected by this factor.

Certain *limitations and uses of the phthlein test* from the surgeon's standpoint are noted by Braasch and Thomas[2] as follows:

It is scarcely a reliable guide, in cases of *prostatic hypertrophy*, as to which cases will stand operation, for, of 168 cases operated upon (Mayo Clinic) for prostatic hypertrophy, 11 had phthalein tests of less than 20 per cent. and had exhibited only trifling improvement in the phthalein output during preliminary treatment, yet only one of these died after operation. On the other hand, 3 cases which had phthalein of 30, 45, and 75 per cent. respectively, died uremic, and several cases with phthalein over 40 per cent. showed uremic symptoms after operation

In cases of *renal calculus*, a marked reduction of phthalein from the affected side is not necessarily a sign of sufficient destruction of renal parenchyma to warrant nephrectomy, for, in some instances following removal of the calculi, the phthalein on that side has returned to normal.

With *tumor* in the renal region, unilateral reduction of the phthalein has aided in localizing the tumor to the kidney when the urine was entirely normal.

In 14 cases of essential *hematuria*, the phthalein elimination was

[1] Archives of Internal Medicine, 1915, xv, 543.
[2] Journal of American Medical Association, 1915, lxiv, 104.

normal. Therefore unilateral hematuria associated with unilateral reduction of the phthalein suggests tuberculosis, calculus, neoplasm or chronic pyelonephritis; on the other hand, a normal phthalein does not exclude these conditions.

When, in early *renal tuberculosis*, tubercle bacilli have been found in the urine and cystoscopic examination fails to determine the affected side, this may sometimes be indicated by a difference in the phthalein output on the two sides. In renal tuberculosis, as a rule, if the total phthalein elimination exceeds 40 per cent. in two hours, the condition is still unilateral; but exceptions to this occur, for in one case of advanced bilateral tuberculosis the phthalein output was 66 per cent.

Perinephritic abscess may give a marked unilateral reduction in phthalein when the urine is quite normal.

In applying the *phthalein test to the determination of the function of each kidney separately*, Smith has simplified the procedure by using a shorter period of collection.[1] He has found that with the ureteral catheters *in situ*, after the injection of 6 mgms. (1 c.c.) of phthalein intravenously, the normal kidney begins to excrete the drug in three minutes, and during the next fifteen minutes each kidney should excrete about 15 per cent. He has found that the amount excreted in fifteen minutes is as reliable a guide to the functional condition of the kidney as is the estimation of an hour's excretion. When one kidney is badly diseased and its phthalein excretion is almost zero, the compensating kidney has been observed to excrete 30 per cent. in fifteen minutes. He has not found ureteral catheterization to have any effect on the time of first appearance nor upon the amount of the drug excreted. His method, in that it shortens the time during which the ureteral catheters must be kept in the ureters, seems to be of value. Other methods of estimating the functions of the two kidneys separately have been studied by Quimby and Fitz (*v. infra*).

Miller and Cabot[2] have used the *phthalein test to study renal function after operation*. They find, as a rule, a diminished output after operation, especially after laparotomy and operations for cancer; in general, the diminution in the phthalein excretion is proportional to the amount of ether used and to the length of the operation. Return to the preoperative level occurs in from about twenty-four to forty-eight hours. Exceptionally, there is no postoperative diminution or there may be, curiously, even an increased output. On the other hand, in rare cases the diminution amounts to total suppression of the phthalein output. The explanation of these extreme variations was not clear, nor could they be correlated with any associated conditions. Shock causes a marked decrease in the output. Postoperative albuminuria was not proportional to the phthalein reduction.

[1] Journal of American Medical Association, 1915, lxiv, 223.
[2] Archives of Internal Medicine, 1915, xv, 369.

That phthalein is eliminated chiefly, if not entirely, by the tubules was the original view of Rowntree and Geraghty, and nothing in subsequent studies has developed to alter this. A further confirmation is found in the studies by Underhill and Blatherwick,[1] and by Potter and Bell[2] of the phthalein test in experimental tartrate nephritis which, in its milder forms, is, histologically, purely a tubular nephritis. They have found it characterized by a very prompt and extreme diminution in the phthalein output, often indeed to zero. In mild cases there occurs, after a few days, a rise in the output to a level somewhat below that of the original output.

Two new investigations concerning the *value of urinary diastase as a test of renal function* have been published, one by Rowntree, Marshall and Baetjer[3] and one by Quimby and Fitz.[4] Both conclude that, in general, this test follows the phthalein test but that it is somewhat less reliable.

Correlation of Renal Functional Tests. Among the most valuable contributions of the year are those that compare several of the functional tests in the same case of experimental or clinical nephritis.

Potter and Bell,[5] in experimental tartrate nephritis, find complete suppression of phthalein, indigocarmin and methylene blue; whereas lactose, potassium iodide and hemoglobin are much delayed or reduced, but not wholly suppressed. They suggest that the first three substances are excreted exclusively through the tubules, the last three mainly by the tubules but in part also by the glomeruli.

Quimby and Fitz,[6] in experimental unilateral uranium nephritis (which is chiefly tubular but in some degree glomerular also), compared the excretion from the normal and pathological kidney as regards amount, specific gravity, chloride and nitrogen output, absolute and percentile, the diastase, hydrogen-ion concentration and freezing-point, and the output of phthalein, indigocarmin and Prussian blue. They found that slight irritation of the kidney, the kidney being still histologically normal, causes a hypersecretion of urine, chlorides and nitrogen, with raised freezing-point on the affected side; occasionally, there is an increased elimination of the dyes. With more definite injury to the kidney, their findings were as follows:

The amount of nitrogen or urea excreted in a given time is lower from the affected side than from the normal side in proportion to the severity of the lesions. This has been found a very valuable test of unilateral renal function in clinical work.

A difference in the diastase content of the urine from the two sides is of significance only when the amount of urine from the two sides is

[1] Journal of Biological Chemistry, 1914, xix, 39.
[2] Loc. cit.   [3] Loc. cit.
[4] Archives of Internal Medicine, 1915, xv, 303.
[5] Loc. cit.   [6] Loc. cit.

approximately the same, a condition which usually did not obtain in their studies.

The urinary freezing-point is higher on the affected side, but this is of less value than the nitrogen content.

Phthalein was found more satisfactory than indocarmin because of the smaller quantity to be injected (1 c.c. instead of 5 c.c.), the shorter time required for the completion of the test and the greater accuracy with which it can be quantitatively estimated; indigocarmin frequently is excreted with a greenish hue that renders its quantitative determination uncertain. Prussian blue, in general, parallels phthalein but is more difficult to estimate accurately.

The urine from the affected side is often less acid, but this is not a sufficiently constant finding to be of value.

Tileston and Comfort[1] note that the depression of the phthalein test and the increase of the non-protein blood-nitrogen are roughly parallel; when the latter is above 100 mgms. the former is usually below 5 per cent. However, a considerable lowering of the phthalein may occur with normal non-protein-nitrogen (especially in passive congestion, and, according to v. Monakow, in the purely degenerative nephritis) and a moderate increase in non-protein blood-nitrogen may occur with absolutely normal phthalein. Frothingham and Smillie[2] observed that the changes in the non-protein blood-nitrogen, resulting from changes in the protein content of the diet, are not accompanied by changes in the phthalein output.

Frothingham has concluded,[3] and the writer agrees with him, that for the early diagnosis of renal disease the most valuable tests are elevation of blood-pressure (taking care to exclude cases of benign sclerosis), repeated urinary examinations (for albumin, casts, doubly refractile lipoids, and erythrocytes), and disturbance of chloride elimination (taking care to exclude extrarenal causes, to which end the study of the chlorides of the plasma should be of great assistance). On the other hand, in chronic renal disease, for the recognition of progress toward the terminal stage and for the discovery of impending uremia, the most valuable tests are the non-protein or urea blood-nitrogen and the phthalein test (and to these might be added fixation of the urinary specific gravity).

Glomerular Function *versus* **Tubular Function.** Stimulated largely by the work of Schlayer, and his associates, there has been for some years renewed attention devoted to the possibility of relating certain excretory renal functions with the glomeruli, others with the tubules. Thus, Schlayer identified with the glomeruli the excretion of lactose and urea, with the tubules, that of iodides and chlorides. V. Monakow, and also Volhard and Fahr, attribute to the glomeruli the elimination of urea

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[1] Loc. cit.   [2] Loc. cit.
[3] American Journal of Medical Sciences, 1915, cxlix, 808.

and to the tubules that of chlorides, but they question, as do several other investigators, the conclusion of Schlayer that lactose is eliminated chiefly by the glomeruli. They also note a frequent disparity between chloride and potassium iodide elimination, although both are supposed to be eliminated by the tubules.

A different view is reached by Leschke.[1] He administered to rabbits and guinea-pigs large doses of chlorides, urea, phosphates, uric acid or iodides, killed the animals during the height of excretion and treated sections of the kidneys by methods appropriate for precipitating these substances. He has found all of these substances most abundant in the lumens of the convoluted tubules, and, after very large doses, also in the lining epithelium of these tubules, to a lesser degree in the lumen of the tubules distal to this part, but in the glomeruli either not at all or at most only in traces. He concludes that the major excretion of all of these substances is in the proximal convoluted tubules, but that possibly to a much slighter extent the glomeruli may also excrete at least some of them. With regard especially to urea, therefore, his view differs from that of Schlayer, of v. Monakow, and of Volhard and Fahr.

Much of the evidence, clinical and experimental, as to the excretory functions of the glomerulus on the one hand, of the tubule on the other, is therefore conflicting, and it seems premature to identify the entire, or even chief, excretion of any one substance with the glomerular function. Indeed, the various substances excreted do not appear to fall into two distinct groups according to the facility of their elimination in the various clinical and experimental renal disorders. As regards the elimination of chlorides and of urea, it is apparent from both experimental and clinical studies, that, in the presence of either a moderate or of a reduced output of urine, a renal insult will first impair the chloride excretion, while only a more severe injury will also impair the urea excretion. On the other hand, it seems clear that an excessive excretion of water more readily washes out with it chlorides than urea. Thus, most observers in this field have reported instances of impaired chloride excretion with normal urea excretion, but, so far as the writer is aware, no observer has reported impaired urea excretion and normal chloride excretion except in association with polyuria.

In the attempt to determine the nature of the urinary albumin in nephritis, whether derived directly from the blood serum by exudation or whether a product of the kidney cells, Salus[2] prepared an antiserum against washed human kidney; he obtained no precipitation or complement-fixation between his antiserum and either human serum or human nephritic urine. Also guinea-pigs sensitized either to nephritic urine or to human serum failed to react with washed human kidney. He concluded, therefore, that the urinary albumin in nephritis is not related

[1] Ztschr. f. klin. Med., 1915, lxxxi, 14.

[2] Biochem. Ztschr., 1914, lx, 1.

to that of the kidney cells. On the contrary, Cameron and Wells[1] have been unable to distinguish at all, by the method of sensitization, between the urinary albumin, kidney protein, and blood-serum protein.

Of interest to the experimentalist is the contribution of Dayton,[2] who found that, out of 21 presumably normal dogs, 10 were found to show changes of chronic nephritis evidenced by increase of connective tissue, with or without round-cell infiltration, glomerular atrophy or increase of the glomerular nuclei or capsular thickening; 7 showed slight changes of a similar nature and only 1 was absolutely normal. Traces of albumin were found in the urine in 7 instances, casts in 2, and in 1 case a large amount of albumin and many hyaline and fatty casts.

Hopkins[3] has studied the blood sugar in 28 cases of renal disease. He found that a slight hyperglycemia occurs in many high-pressure nephritics and frequently in those with low phthalein output. No relation was observed between the height of the blood-pressure and the degree of the hyperglycemia. In most nephritics without elevation of blood-pressure, he found the blood-sugar normal, and he noted no influence from edema or hepatic congestion upon the amount of blood-sugar. In the later study of Hopkins and Jonas,[4] they found that of 8 cases that showed increased non-protein blood-nitrogen, 4 showed increased blood-sugar. Variations in the protein content of the diet did not appear to influence the blood-sugar.

Uremia. We have already discussed (see p. 138) the relation between uremia and increased non-protein-nitrogen in the blood. While in a large proportion of cases of uremia the non-protein blood-nitrogen is increased, it has as yet been impossible to identify the particular substance responsible for the toxic manifestations, nor is it proved that this substance is nitrogenous in nature. The nitrogenous substances known to be increased in the blood, such as urea and creatinine, fail to give rise to the toxic symptoms characteristic of uremia when injected even in large amounts. Hartman[5] has isolated from the urine a light yellow oil possessing the empirical formula C_6H_8O and giving the reactions of a cyclic ketone. This oil, which he calls *urinod*, has the odor described as urinous, and is apparently the source of the odor of urine. It exists, it is believed by Hartman, in conjugated form in normal urine. When isolated in the free state, however, it is intensely toxic. Injected into the frog or lizard, it causes twitching, dyspnea, increased irritability, convulsions and eventually death from respiratory failure. Similar symptoms are produced in the mouse, for which animal $\frac{1}{3000}$ part of the

[1] Archives of Internal Medicine, 1915, xv, 746.

[2] Journal of Medical Research, 1914, xxxi, 177.

[3] American Journal of Medical Sciences, 1915, cxlix, 254.

[4] Loc. cit.

[5] Archives of Internal Medicine, 1915, xvi, 98.

body weight of urinod is fatal.   Hartman tested the effects of extremely minute doses upon himself, and observed intense nausea, occipital headache, loss of appetite, heaviness of the stomach after meals, drowsiness and constant weariness.   Irritability of temper, restlessness, insomnia, inability to concentrate the attention, chilliness and desire for frequent micturition occasionally could be noted.   Hartman suggests that since the odor of urine is due to urinod, the presence of a urinous odor on the breath, skin and in the blood of the uremic patients may well be evidence of urinod retention.   Further, that since the symptoms of urinod poisoning resemble in many respects certain of the nervous symptoms of uremia, it is possible that urinod retention may partly account for these symptoms.

From uremic blood Foster[1] has reported the isolation of a highly toxic crystalloid not found in normal blood which, upon injection, excites many of the symptoms of uremia.   The nature of this substance he has not yet published.

That at least certain cases of uremia are associated with some degree of acidosis has been recognized.   Straub and Schlayer, Porges and Leimdorfer, Poulton and Ryppel have observed a decreased carbon dioxide tension in the alveolar air, indicating acidosis, in cases of uremia. Peabody[2] has studied this relation of acidosis to renal disease in a series of cases, both by estimating the carbon dioxide tension of the alveolar air and the hydrogen-ion concentration of the blood, and has sought to determine whether this acidosis may be the cause of the dyspnea of certain cardiorenal cases.   He finds that in many cases of chronic nephritis without uremia, there is an extremely mild acidosis, but that, in nephritis, marked acidosis, with considerable lowering of the carbon dioxide tension of the alveolar air, is observed only in association with uremia and usually only with severe uremia.   On the other hand, he has observed instances of marked uremia without acidosis.   Moreover, too much significance must not be attributed to this acidosis of uremia, for even only twelve hours before death it is, as a rule, not so marked as that characteristic of advanced diabetic coma.   It does not seem possible to consider acidosis the cause of uremia.   He finds no constant proportion between acidosis in renal disease and increase in the non-protein bloodnitrogen.   The latter may be very high without any trace of acidosis. He finds also that the dyspnea is not proportional to the degree of acidosis, hence the latter can not, as a rule, be the major factor in inducing the dyspnea.

Henderson and Palmer[3] have investigated the hydrogen-ion concentration (acidity) of the urine, the amount of injected alkali required

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[1] Transactions of Association of American Physicians, 1915, xxx.

[2] Archives of Internal Medicine, 1914, xiv, 236.

[3] Ibid., 1915 xvi, 109; also Journal of Biological Chemistry, 1915, xxi, 37.

to reduce the urinary acidity and the quantitative excretion of acid and of ammonia in the urine. We have been accustomed to consider the excretion of increased amounts of acid bodies and of ammonia a characteristic feature of the state of acidosis. Henderson and Palmer find, however, that many cases of chronic nephritis show a very low excretion of ammonia, associated with a normal or slightly subnormal or slightly increased excretion of acid. This combination results in a urine of high acidity. They note that, as a rule, cases with very low ammonia excretion are characterized by high non-protein blood-nitrogen, but this relation does not always hold. They have not compared these alterations in the excretion of acid and of ammonia associated with increased urinary acidity with the alveolar carbon dioxide tension or the hydrogen-ion concentration of the blood, but, from the observation that certain of these cases must be given an unusually large amount of sodium bicarbonate to alter the urinary acidity they have assumed that we have instances of true acidosis with reduced, instead of increased, urinary ammonia. In their cases they have determined the ratio of the acid in the urine to the ammonia (in terms of cubic centimeters of $\frac{N}{10}$ solution), and find that, normally, this ratio $\left(\dfrac{\text{acid}}{\text{ammonia}} \right)$ is about 0.8. In their nephritic cases, the value of this ratio is usually higher, due chiefly, as a rule, to reduction in the ammonia excretion, and they have divided these cases into two groups. In the first are the severer ones, with a ratio above 1.4; as a rule, these cases exhibit a large amount of urine of extremely high hydrogen-ion concentration (acidity), with diminished amount of acid in the urine, but a still greater diminution in the ammonia, with high blood-pressure and high non-protein blood-nitrogen and with low phthalein output. These cases are, for the most part, late stages of glomerulonephritis. In the second, and milder group, are the cases with a ratio below 1.4; these cases exhibit a urine about normal in amount, with an acidity high or even extremely high, with an excretion of acid that may be low or normal but with a slightly lower output of ammonia in proportion, and with less constant abnormality of the blood-pressure, non-protein blood-nitrogen and phthalein test. The cases are, for the most part, instances of degenerative nephritis or of earlier stages of glomerulonephritis. The tabulation of the means from their cases grouped according to the acid-ammonia ratios is as follows:

Ratio.	Volume of urine.	Hydrogen-ion concentration of urine (logarithm).	Acid of urine (c.c. of $\frac{N}{10}$ sol.).	Ammonia of urine (c.c. of $\frac{N}{10}$ sol.).
Over 1.6	1650	−5.2	318	165
1.3 to 0.8	1086	−5.2	287	276
Under 0.8	1187	−5.6	244	341
Normal cases	1206	−5.9	275	368

The relation of their findings to retention of ammonia in the blood, as found by Foster in certain nephritics, would be of much interest.

Nephritis. In their treatment of the subject of Bright's disease, Volhard and Fahr offer the classification given in the following table, the terms in brackets being the untranslated terminology:

A. Degenerative nephritis [nephrosen]. This may be with or without amyloid changes. There is no elevation of blood-pressure.
    I. Acute stage.
    II. Chronic stage.
    III. Terminal stage [nephrotic, contracted kidney] very rare.
B. Inflammatory nephritis [nephritis].
    1. Diffuse glomerulonephritis, characterized by elevation of blood-pressure.
        I. Acute stage (intracapillary or capsular).
        II. Early chronic stage (no evidences of renal insufficiency).
        III. Terminal stage (with renal insufficiency).

With any of these stages there may be associated more or less degenerative tubular nephritis.

    2. Focal nephritis (no elevation of blood-pressure).
        (a) Focal glomerulonephritis.
            I. Acute stage.
            II. Chronic stage.
        (b) Acute interstitial non-suppurative nephritis.
        (c) Embolic nephritis.
C. Sclerotic processes [sclerosen], associated with very high blood-pressure.
    I. Simple sclerosis (little or no glomerular change, no evidence of renal insufficiency, benign hypertension).
    II. Combination form (sclerosis associated with secondary glomerular changes, with renal insufficiency, malignant hypertension).

In the following paragraphs the attempt will be made to point out very briefly the characteristics of the various types of nephritis as distinguished by Volhard and Fahr.

DEGENERATIVE NEPHRITIS. In this group are placed the nephropathies characterized by degeneration or necrosis of the tubular epithelium without glomerular change, or with, at most, congestion of the glomeruli and possibly a little albuminous exudate in the capsules of Bowman. It is the typical nephritis induced by mercuric salts, chromates, and tartrates and may be caused by certain bacteria or other toxins. There may be, in the chronic forms, associated amyloid change and the second stage constitutes one of the forms of "large white kidney."

The supposed etiology of Volhard and Fahr's 55 cases is as follows:

	Acute.	Chronic.	Terminal.	Total.
Unknown	—	7	—	7
Pregnancy	2	—	—	2
Diphtheria	7	—	—	7
Tuberculosis	—	15	3	18
Syphilis	2	5	—	7
Chronic suppuration	—	3	—	3
Pericarditis (Streptococcus viridans)	—	2	—	2
Staphylococcus sepsis	1	—	—	1
Measles	1	—	—	1
Sarcomatosis	—	1	—	1
Mercuric chloride	6	—	—	6
Total	19	33	3	55

Clinically, the most characteristic symptom is edema. Elevation of blood-pressure is not observed, and cardiac hypertrophy is absent. The urinary output varies according as the edema is increasing or diminishing, its specific gravity is usually high and albumin abundant. In the sediment are casts of all kinds, fatty cells, doubly refractile lipoids but only exceptionally erythrocytes.

These doubly refractile lipoids occur as globules which with the ordinary microscope are indistinguishable from the fatty globules of fatty degeneration, but which, when examined with a polarizing microscope between crossed prisms, are found to be doubly refractile, each globule appearing as a bright maltese cross of light in the otherwise dark field. These globules consist of cholesterin esters. They are a normal constituent of the cells of the adrenal cortex, but in the kidney in the parenchymatous organs in general and in the atheromatous patches in the arteries, they develop as the result of degenerative changes. Their significance is apparently somewhat more serious than is that of ordinary fatty degeneration. In the urine, the globules appear either free, in compound granule cells, or sometimes in the cells of epithelial casts. It has been held that their presence in the urine is evidence of a degenerative process of sufficient severity to justify confining the patient to his bed until after their disappearance. While these doubly refractile lipoids may occur in the urine in any severe degenerative nephritis, they are especially frequently found in degenerative nephritis of syphilitic origin, as first pointed out by Munk and recently confirmed by Stengel and Austin.[1]

This group is almost the same as that described by v. Monakow as "hydropic anazotemic nephritis." He finds almost constantly faulty elimination of sodium chloride, as shown either by retention of chlorides in a balance experiment with ordinary chloride intake, or, more reliably, by failure to eliminate promptly an added dose of 10 grams of sodium

[1] American Journal of Medical Sciences, 1915, cxlix, 12.

chloride. As a rule, the nitrogen elimination is normal, and added urea is promptly excreted, often with diuresis. In the severer cases, however, nitrogen excretion also is impaired or there is increased non-protein blood-nitrogen, as observed by Foster[1] in a case of mercuric chloride nephritis, and as noted by Karsner and Denis[2] in experimental chromate and tartrate nephritis.

As a rule, in these cases, administration of sodium chloride leads to diminished output of urine, increase in body weight, increase in the albuminuria, and sometimes to visible increase in the edema. This observation, made repeatedly by v. Monakow while using added sodium chloride as a test of renal function, is of interest at this time in view of the treatment of nephritis and edema urged by Fischer. A much less frequent finding noted by v. Monakow, as well as by other investigators, is the occurrence of chloride retention without reduction of urinary output or increase of body weight; as a rule these cases exhibit only a very slight edema, and are sometimes spoken of as instances of "dry salt retention."

The phthalein elimination in this form of nephritis is very variable, and may be normal, unduly high or quite low.

Uremia is a very rare feature of this form of nephritis, except in the severest cases, such as certain instances of bichloride poisoning. Recovery after removal of the cause, or death from intercurrent affection or from the condition responsible for the nephritis, is the usual termination.

The addition of amyloid infiltration to the pathology does not, according to Volhard and Fahr, cause any alteration in the clinical picture.

GLOMERULONEPHRITIS. In this group fall by far the larger proportion of nephritic cases characterized by severe disturbance of renal function and with a tendency to uremia. Histologically, the characteristic feature is exudation into the capsule of Bowman or proliferative changes in either the glomerular tuft or in the capsular wall and eventually the hyalinization, atrophy or obliteration of many of the glomeruli. More or less damage to the tubular epithelium is an associated condition, and when, in the advanced stages (secondarily contracted kidney) many of the glomeruli are wholly obliterated, it must be remembered that, since the blood supply of the tubules belonging to a glomerulus is received largely *via* that glomerulus, the obliteration of a glomerulus must necessarily involve the obliteration, at least functionally, of that entire tubule likewise. Hence the disturbances of the renal functional tests so extreme in the late stages of glomerulonephritis, must be attributed not to the loss of glomerular excretory function alone, but rather to the complete obliteration of a considerable proportion of the total renal excretory tissue, tubular as well as glomerular.

[1] Loc. cit.   [2] Journal of Experimental Medicine, 1914, xix, 263.

In the etiology of glomerulonephritis, either acute or chronic, and whether the chronic stage follows an acute stage or whether it develops directly and insidiously, the most frequent factor, according to Volhard and Fahr, is bacterial infection and in this view they are supported by many other observers. Of especial importance are the streptococci and the related organism, the pneumococcus.

The following table of apparent etiological factors in 195 cases of glomerulonephritis and 10 cases of acute, interstitial, non-suppurative nephritis is given by Volhard and Fahr.

	Nephritis.							
	Diffuse.			Focal.				
				Glomerular.				
	Acute.	Chronic.	End.	Acute.	Chronic.	Interstitial.	Embolic.	
Diphtheria	17	7	13	11	4	1	--	53
Scarlet fever	19	2	--	6	4	4	--	35
Infected wounds	7	3	1	2	--	2	2	17
Erysipelas	1	--	1	3	--	--	--	5
Rheumatism and endo- carditis	2	1	2	1	--	--	5	11
Purpura	2	--	--	1	--	--	--	3
Influenza	8	5	6	1	3	--	--	23
Pneumonia, bronchitis, empyema, pleurisy	6	--	1	3	--	3	--	13
Tuberculosis	3	1	--	1	1	--	--	6
Gastro-enteritis	--	1	--	2	--	--	--	3
Malaria	--	1	--	--	--	--	--	1
Lead	--	--	3	--	--	--	--	3
Pregnancy	4	2	1	--	--	--	--	7
Unknown	2	9	10	1	2	--	1	25
Total	71	32	38	32	14	10	8	205

The writer has been impressed by the frequency with which a history of streptococcic or pneumococcic infection antedates, by two or three years, the first noticed symptoms of those insidious cases of chronic nephritis that reach the terminal stages with marked renal insufficiency without any acute nephritis having been noted.

Dick and Dick[1] have isolated certain organisms from the urine of acute and chronic nephritis. Of these organisms, the most frequent are streptococci and a small anaërobic Gram-negative bacillus. In certain nephritics they have isolated the same organisms from the urine and from the diseased tonsils. In addition, they have succeeded in inducing a glomerulonephritis in rabbits by the injection of certain of these organisms recovered from nephritic urine. Their findings are certainly interesting and deserve confirmation.

Volhard and Fahr have concluded, from their studies, that the most valuable characteristic for distinguishing between simple degenerative

[1] Journal of American Medical Association, 1914, lxiii, 1661; ibid.,1915, lxv, 6.

nephritis and acute glomerulonephritis is elevation of the blood-pressure which is absent in the former, whereas it is almost invariably present in glomerulonephritis. Only in high fevers or in states of great weakness have they found high blood-pressure wanting in diffuse glomerulonephritis. Cardiac hypertrophy also may be observed at a very early stage, as has been noted recently by Wessler[1] in studying nephritis in children.

At the onset, oliguria, hematuria, impaired chloride excretion, edema, impaired nitrogen excretion, increased non-protein blood-nitrogen, which in anuric cases may become very high, and moderate or extreme reduction in the phthalein output are common features. Uremia is not rare. As improvement sets in, if it does so, the renal functional tests return toward normal, the edema diminishes or disappears, but, if there persists any considerable pathological change in any large proportion of the glomeruli, thus constituting the early stage of chronic diffuse glomerulonephritis, the blood-pressure as a rule remains elevated. Indeed, throughout the early chronic stage, elevation of blood-pressure, with more or less albumin and casts in the urine, frequently constitutes the only evidence of renal disease. When uremic symptoms develop, it is usually in association with very high non-protein blood-nitrogen. Occasionally, however, this is not the case. In such instances, according to Volhard and Fahr, the convulsive seizures are not to be regarded as having the same serious prognostic significance that is properly attributed to uremic attacks associated with high non-protein blood-nitrogen.

Kinloch[2] has made a study of both the acute glomerulonephritis and the acute interstitial non-suppurative nephritis occurring in scarlet fever and diphtheria. He finds that glomerulonephritis developing in either disease is, as a rule, characterized by an initial rise in temperature, edema, urine containing albumin, casts and blood, and an initial oliguria. He has found that the urinary amount in the diphtherial nephritis as a rule returns quickly to normal, but in the scarlatinal the oliguria is quite persistent. The chloride excretion follows the water output. Impaired nitrogen excretion, absolute and percentile, was noted in the scarlatinal cases but not in the diphtherial. The acute, non-suppurative interstitial nephritis occurring in either disorder gave rise to practically no disturbance of renal function except for some degree of albuminuria and the occasional finding of scanty casts.

The second stage, or early chronic glomerulonephritis, may follow an acute stage or may develop insidiously. The histological changes are similar to those of the acute stage, but with the proliferative changes in the glomeruli and the degenerative changes in the tubules more pronounced and with less exudative phenomena. Grossly, the kidney is usually a large, white kidney resembling that of chronic, degenerative

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[1] Archives of Internal Medicine, 1914, xiv, 517.

[2] Journal of Pathology and Bacteriology, 1914, xix, 77.

nephritis, and, like it, commonly classed as "chronic parenchymatous nephritis." The kidney may exhibit a typical histology, however, without increase in size. Clinically, the picture is that of a tendency to arterial hypertension, often showing rapid fluctuation in the blood-pressure, and to cardiac hypertrophy, usually with more or less albumin and casts. The renal functional tests are, as a rule, normal, or, if there be considerable associated tubular degeneration, there may be a tendency to chloride retention and edema. Nitrogen elimination and the non-protein blood-nitrogen are usually quite normal. The phthalein test may be slightly impaired, but is often quite normal or above normal. As a rule, the eye-grounds show no changes.

Obviously, renal disease in this stage may be easily overlooked or interpreted as the benign hypertension of simple renal sclerosis. Volhard and Fahr note four types of early chronic glomerulonephritis according to the symptomatology:

1. Cases showing albuminuria and a tendency to increased blood-pressure but without subjective symptoms.

2. Cases subject to recurrences of acute glomerulonephritis.

3. Cases with headache, lassitude, vertigo, anemia or pain over the kidneys.

4. Cases with edema.

The outcome of this early chronic glomerulonephritis may be:

1. Death from intercurrent infection.

2. Cardiac decomposition consequent upon the high blood-pressure and leading to cardiac edema and renal insufficiency (from renal congestion).

3. A gradual transition to the third or terminal stage with renal insufficiency while still maintaining good cardiac compensation.

Obviously, the treatment of these three groups is different. In the second, the chief attention must be directed to cardiac stimulation; in the third, to restriction of protein and salt intake and to such eliminative measures as purgation and sweating. It must be remembered that a falling phthalein output will occur in all three groups.

The terminal, or third stage of glomerulonephritis may either follow the acute and early chronic stage or the latter alone, or it may develop insidiously and no symptoms be noted until the patient is in this stage; the latter course is very common.

In this stage the characteristic histology is the atrophy, hyalinization or complete fibrosis of a considerable proportion (often three-fourths or more) of all the glomeruli. As has been noted, this implies the functional loss of the corresponding tubules which is often histologically indicated by their atrophy and replacement in large part by connective tissue. The remaining tubules are usually distended and exhibit flattened and sometimes degenerated epithelium. Some degree of sclerotic change in the renal vessels is always observed. Grossly, Vol-

hard and Fahr have found this kidney very variable, a fact that has undoubtedly in the past been one of the obstacles in the way of correlating clinical and pathological findings. Usually, this kidney is the typical secondarily contracted kidney with adherent capsule, finely granular surface and pale color; but this is not always the case. The color is not always pale; in a fair proportion of cases the kidney is little, if any, smaller than normal; the capsule may be scarcely adherent and the surface may be smooth; yet histologically the extensive destruction of glomeruli adequately explains the reduced renal function.

Clinically, the renal insufficiency is shown by the inability of the kidney to excrete a concentrated urine, and the specific gravity remains always low. After the administration of sodium chloride, the elimination of the chlorides, if adequate at all, is attained only by means of a marked polyuria; indeed, for this very reason a more or less persistent polyuria is the rule. At first, the kidney still retains the ability to dilute the urine, and after the administration of much distilled water the specific gravity may fall to 1.005 or less. Eventually, however, even this form of varying the urinary composition is lost, and the urine acquires a fixed specific gravity at about 1.011 to 1.013. The nitrogen elimination is impaired, and there is a striking tendency to increase in the non-protein-nitrogen of the blood.

Volhard and Fahr point out that the polyuria of this condition is not evidence of increased power for water elimination on the part of the kidneys. The normal kidneys can eliminate 500 c.c. of urine in a half-hour or at the rate of 24 liters per day, a rate of water elimination not possible from the nephritic kidney in the stages under consideration. The polyuria is to be regarded as an effort to eliminate the solids when only a urine of low specific gravity and concentration can be secreted.

All the other functional tests, of which phthalein may be taken as the best illustration, are greatly reduced. The phthalein output is often only mere traces or none at all. Albumin and casts, while present, are conspicuous only after there is cardiac decompensation, and the same is true of edema. The blood-pressure is rarely below 170 systolic, and even after cardiac decompensation the diastolic pressure usually remains above normal. Smith and Kilgore[1] have noted the frequency of widening of the arch of the aorta, it being more than the normal 6 cm. in 11 out of 14 cases, and over 7 cm. in 7 cases. The eye-grounds are characteristically diseased, usually showing albuminuric retinitis. The increased non-protein-nitrogen of the blood is influenced by the protein content of the diet, as shown by Frothingham and Smillie, and by Hopkins and Jonas, but, with the advance of the disease, it soon can no longer be kept within normal figures by dieting and often reaches extremely high figures.

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[1] American Journal of Medical Sciences, 1915, cxlix, 503.

The typical termination of these cases is by uremia. Failure of the cardiac compensation hastens this termination, for, with impaired circulation, the polyuria gives way to oliguria, and the already imperfect output of solids in the urine becomes poorer. In this event, albumin and casts become abundant in the urine and edema of cardiac distribution may appear.

The duration of the various stages of glomerulonephritis, from its onset to its termination, is very variable and appears to depend largely on the virulence of the etiologic noxa. Volhard and Fahr have observed the typical end-stage clinically and histologically developed within a year of the onset. On the other hand, they have observed cases that pass from the second to the third stage only after a course of ten to twenty years.

Focal glomerulonephritis and embolic nephritis are characterized chiefly by hematuria, gross or microscopic, persistent or intermittent, associated with slight to moderate albuminuria and casts, and sometimes, especially in chronic cases, with pain, often quite severe, over the affected kidney. There is no elevation of blood-pressure, no disturbance of water, chloride or nitrogen elimination and the phthalein and other functional tests are normal.

Arteriosclerotic Processes. In this group the histological studies of Volhard and Fahr are of especial interest. They call attention to the well-known fact that while sclerosis of the larger and middle-sized renal arteries may be a conspicuous feature of the renal histology and may cause puckering and scarring of the renal surface, such sclerosis is not correlated with any typical clinical picture. On the other hand, whenever there is present any considerable thickening of the intima of the smallest renal vessels, there is, clinically, extremely high blood-pressure, among the highest pressures ever observed, and marked cardiac hypertrophy. Indeed, the elevation of blood-pressure associated with sclerosis of the smallest renal arteries commonly exceeds in degree that resulting from glomerulonephritis. Further, they have observed that in most of these cases of sclerosis of the type under consideration the great majority of the glomeruli are normal or almost so, and presumably capable of excellent function, and the tubules show little pathological change. It is perhaps not surprising, therefore, that these cases during life, in spite of the very high blood-pressure, exhibit normal renal function as regards the output of water, chlorides, nitrogen, phthalein and other substances, so long as cardiac compensation remains good. These constitute that group to which attention has been called by Jores, Löhlein, Janeway and Stengel and which has been variously called simple or primary renal sclerosis, or benign hypertensive cardiovascular disease. It is truly a vascular disease rather than a renal one. Only when cardiac decompensation consequent upon the long-sustained high tension occurs, does the renal function become

inadequate, with falling urinary output, decreased excretion of chlorides and nitrogen, increase of the non-protein-nitrogen of the blood and falling phthalein output; all of these occurring in about the degree and proportion observed in renal passive congestion incident to failing cardiac compensation from any cause.

Grossly, these kidneys may be normal in size or contracted, and, as to surface, smooth, lobulated or granular.

These cases occur with increasing frequency in each decade of life, one case being noted by Volhard and Fahr, as early as the second decade, to reach the maximum incidence between fifty and seventy years of age. Cardiac hypertrophy is, in their experience, more pronounced the earlier in life the condition develops. Probably in those cases developing later, coronary sclerosis prevents cardiac hypertrophy. The blood-pressures are, as has been stated, among the highest ever observed. Thus, of 268 cases in their series, 102 had systolic pressures over 200, 104 between 170 and 200, and only 61 lower than 170.

The predominant symptoms are cardiac and asthmatic.

The urine exhibits a specific gravity which, in contrast to cases of late glomerulonephritis, may, on a dry diet, rise to 1.025 or 1.030. There may be traces of albumin, and occasionaly hyaline and granular casts. The lactose test is, according to Volhard and Fahr, often impaired, but this is also true in their experience in many elderly persons without hypertension. The eye-grounds show sclerosis, but not albuminuric retintitis.

Uremia with increased non-protein blood-nitrogen does not occur, but attacks somewhat resembling uremic seizures, preceded by headache, vertigo and ringing in the ears, are seen and are attributed by Volhard and Fahr, as by Widal, Strauss, v. Monakow and others, to alterations in the cerebral circulation.

The termination of these cases is either by cardiac decompensation with edema and secondary renal insufficiency, or by vascular accidents, such as cerebral thrombosis or hemorrhage.

The therapy appropriate to these cases is primarily a cardiovascular therapy; rest, sufficient to spare the heart, cardiac stimulants, especially the digitalis group when decompensation appears, and in the treatment of the edema that appears with decompensation, theocin or one of the other caffein diuretics. Stengel[1] has called attention to the especial value of theocin in these cases, probably due to the large amount of well-preserved and functionally capable renal substance. The use of nitrites or other drugs to reduce the blood-pressure and "save the heart" is either unavailing or disastrous. The elevated pressure is to be looked upon as a necessary adjustment to compensate for the tendency to reduced flow through the sclerosed renal vessels and dilatation of the

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[1] Loc. cit.

dilatable peripheral vessels with nitrites will lead first, as a rule, to increased cardiac output in the effort to maintain the high pressure and hence to increased cardiac work and later possibly to a hastened cardiac decompensation with the undesirable results already detailed. Only in such acute accidents as cerebral hemorrhage is the use of the vaso-dilators justifiable. Extreme eliminative measures and vapor baths are quite unnecessary, and merely weaken the patient.

Individuals with this benign hypertension have been observed by Stengel, and others, to carry a systolic blood-pressure of over 200 for thirty years without obvious detriment.

COMBINATION FORM—ARTERIOSCLEROTIC NEPHRITIS. Volhard and Fahr have made the new and important observation that in about 10 to 15 per cent. of cases of simple benign sclerosis of the type just described, there develops insidiously, while cardiac compensation is still good, all of the signs of renal insufficiency that characterize the third stage of glomerulonephritis and the case may terminate in true uremia. Upon histological examination, the kidneys of such cases, in addition to the intimal thickening of the smallest renal vessels, show extensive glomerular atrophy or hyalinization or fibrosis of many glomeruli. We are dealing here, they believe, with a glomerular destruction secondary to the primary sclerotic change brought about by some as yet unknown mechanism. Only rarely can the glomerular disease be traced to an infection. Syphilis seems not to be a factor. As yet they have found no means by which they may predict whether a simple benign sclerosis will pursue its usual course to a cardiovascular termination or whether it will prove one of the small minority that undergo transition to the combination form.

The relative frequency of these different types of chronic renal disease associated with hypertension, in Volhard's and Fahr's series, is as follows: Third stage of glomerulonephritis, 38 cases; simple benign sclerosis, 268 cases; combination form, 36 cases. The greatest number of cases of the combination form fell in the years from forty to sixty; hence a little earlier in life than the maximum incidence of the simple benign sclerosis.

Of the 36 cases, 28 exhibited sytolic blood-pressure of from 200 to 280, 7 had pressures between 170 and 200, and one a pressure under 170. The pressures for the group therefore average a little higher than in the groups of simple sclerosis and glomerulonephritis, but the blood-pressure would be of no value in assigning any particular case to its proper group.

The first clinical evidence of transition from simple benign sclerosis to the combination form was, in their series, quite frequently the development of albuminuric retinitis. About the same time the other evidences of impaired renal function appear; namely, a tendency to polyuria with low specific gravity, impaired elimination of nitrogen with increased non-protein blood-nitrogen, good chloride elimination, while polyuria

persists but inability to excrete chlorides in high concentration, reduction in the phthalein and other functional renal tests.

The symptomatology is a combination of the cardiovascular and asthmatic features of simple benign sclerosis with the toxic and uremic manifestations of late glomerulonephritis. The relative prominence of these two groups of symptoms varies in individual cases. About half the cases eventually exhibit cardiac edema, but death from uremia is the rule.

Concerning the etiology of simple sclerosis and of the combination form, Volhard and Fahr have nothing new to present, merely enumerating the commonly accepted causes of arteriosclerosis in general.

TREATMENT OF NEPHRITIS. Although the functional tests and histological studies have improved our classification of nephritis and increased our accuracy of diagnosis, a commensurate progress in therapy has not yet been made.

In the handling of cases of renal disease with edema, the restriction of fluid and salt intake is probably the most important measure. In view of the recent claims of Fischer, that salt in concentrated solution (1.5 per cent.) is of value for diminishing edema and relieving the anuria of acute nephritis, it is worth while to call attention to the careful observations by v. Monakow on the effects of adding 10 gms. of sodium chloride to the intake in various types of nephropathy without material increase in the water intake. In every case with renal edema in his series, there was associated some disturbance of chloride elimination. In most of these cases the administration of extra sodium chloride caused decreased output of urine and of sodium chloride, increase in the edema, and, in several instances, increase in the albuminuria. In a few cases of chloride retention without edema, the added chloride caused no reduction in the urinary output and no increase in the body weight. In no case that exhibited edema or chloride retention, however, did salt administration increase the urinary output or reduce the body weight. Both Schlayer and Mosenthal have noted that, in a certain stage of experimental uranium nephritis, the kidney is very sensitive to sodium chloride and may be thrown into an anuric state by its administration. This observation emphasizes the possible danger of a salt therapy.

V. Monakow has made the interesting observation that in most cases with impaired chloride elimination but normal nitrogen elimination, the usual finding in simple degenerative nephritis, the administration of urea has a pronounced diuretic effect, even when there is no response to theocin or other caffein diuretics. He reports the use of urea therapeutically in one such case with success. On the other hand, cases with impaired nitrogen elimination but capable of eliminating chlorides, a condition seen in the polyuric stage of late glomerulonephritis and of the combination form, exhibit no diuresis upon urea administration, but do react to chlorides with an increase in the polyuria.

In an effort to define more precisely the indications for the caffein diuretics, several studies have been made. Christian and Hare had previously shown that, in acute experimental nephritis in rabbits, life was somewhat shortened by the administration of theobromin sodium salicylate (diuretin) or of theocin. In a new communication[1] Christian finds that, in uranium nephritis in rabbits, if the nephritis be severe, he can demonstrate no benefit either by increased water or phthalein output following the diuretic. When the nephritis was milder, an occasional but quite inconstant beneficial effect was noted. Fitz[2] has approached the same problem in almost the same way. He finds that, in the normal rabbit, these diuretics cause an increased output of urine and chlorides, and to a lesser extent, of nitrogen and phthalein. After repeated small doses, the increased secretion of these substances begins to lessen. In uranium nephritis, a similar effect was observed from the diuretics, but the ultimate diminution occurred earlier. In chromate nephritis, the fall came still earlier, indeed the nitrogen and phthalein output was not increased by the diuretics at all. The writer has recently observed an instructive case in which, during an acute nephritis of colon bacillus origin with low urinary output, greatly impaired chloride and nitrogen output, very high non-protein blood-nitrogen and marked elevation of blood-pressure, administration of theocin (four doses of 1 gram each in thirty-six hours) was followed by prompt reduction of the already low urinary output, with still greater reduction of the chlorides and nitrogen. V. Monakow has tested the reaction to theocin in many of his cases, but finds no constant relation between the response to this diuretic and to the other functional tests.

Stengel has found the caffein diuretics of greatest value in cases of simple sclerosis with cardiac decompensation and consequent edema, the renal function in these cases being relatively intact; these cases are more frequent than are those in which the renal element is the predominant one.

In those cases characterized by a tendency to increased non-protein blood-nitrogen and by faulty nitrogen elimination, Frothingham and Smillie,[3] and also Hopkins and Jonas[4] have shown that the non-protein blood-nitrogen can be kept considerably lower by restricting the protein in the food, say to 35 to 40 gms. per day. In the milder cases, the blood-nitrogen will remain normal on such a regime, but, in the severe cases, this degree of control cannot be attained. Frothingham and Smillie could only occasionally observe any subjective improvement associated with this lowering of the blood nitrogen.

Austin and Leopold[5] have attempted to determine, experimentally, the effects of glucose given by mouth or (as a 10 per cent. solution)

[1] Archives of Internal Medicine, 1914, xiv, 827.
[2] Ibid., xiii, 945.
[3] Loc. cit.
[4] Loc. cit.
[5] Proceedings of Pathological Society of Philadelphia, 1915.

intraperitoneally upon the non-protein blood-nitrogen and the duration of life after producing acute renal insufficiency by bilateral ureteral ligation. They find that animals receiving glucose not only show a lower non-protein blood-nitrogen than animals receiving meat, but the duration of life in the former animals is materially increased. Therefore it is probable that the regime that will keep the non-protein blood-nitrogen nearer the normal level will also lessen the renal toxemia.

It is likewise in these cases that vapor baths are most useful, as has been emphasized by Stengel. In just what way the vapor baths are beneficial is not altogether clear. Austin and Miller[1] studied the non-protein-nitrogen of the blood before and at various periods after vapor baths in 12 nephritics, but could demonstrate no effect of the procedure upon the blood-nitrogen.

Concerning the administration of fluids in nephritis, it may be suggested that a rational procedure would be the determination of the concentration at which the particular kidneys are capable of secreting urea and chlorides and the administration of such an amount of water as will lead to a urinary excretion just sufficient to readily carry away the chlorides and nitrogen permitted in the diet.

Of considerable importance for the prophylaxis and therapy of nephritis is the increasing tendency to look upon glomerulonephritis, whether of the frank, acute type or the insidiously developing, chronic type, as a consequence of bacterial infection in the great majority of instances. By more careful search for evidences of impaired kidneys in the course of a convalescence from infection, and especially from streptococcic or pneumococcic infections, cases may probably be detected in an earlier stage. In addition to urinalysis and repeated blood-pressure observations, the renal functional tests should be made use of for this purpose, the most valuable at this stage being probably the ability to eliminate chlorides promptly, the phthalein test and the non-protein blood-nitrogen. The protection of the kidneys at this stage by prolonging the period of convalescence and by avoidance of renal irritants, including salt, would probably prevent, in some instances, later chronic glomerulonephritis.

A second method of attack, which the probably infectious origin of these cases suggests, is the search for and eradication of foci of chronic infection around the sinuses, teeth, tonsils and elsewhere.

In certain carefully selected cases of acute nephritis with oliguria or anuria, edema and incipient uremia, especially in postscarlatinal nephritis of children, decapsulation of the kidney has been found of value when the ordinary measures have failed to give relief.[2]

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[1] Journal of American Medical Association, 1914, lxiii, 944.

[2] New York Medical Journal, 1915, ci, 70.

Renal Tuberculosis. In reporting 7 cases of renal tuberculosis, Marogna[1] notes that, in all 7, the first symptom was irritability of the bladder with frequency of urination, especially at night. The importance of careful and prompt investigation of all cases complaining of bladder symptoms can not be too strongly urged. Not infrequently a collargol injection and x-ray study will reveal the nature of the underlying condition. Unilateral reduction of phthalein output should suggest renal tuberculosis. According to Brown,[2] the presence of albuminuria in a patient with pulmonary tuberculosis should make one suspicious. In 3 of Marogna's cases, slight hematuria was observed, and, according to Braasch and Thomas, unilateral hematuria with unilateral reduction of phthalein is strongly suggestive of renal tuberculosis, although it may be due to neoplasm, calculus or chronic pyelonephritis.

The importance of early diagnosis deserves emphasis, for while at least 85 per cent. of cases of renal tuberculosis are unilateral at the onset, infection of the other kidney occurs within three years in the majority of unoperated cases, and only 20 per cent. pass the fifth year with the second kidney uninvolved.[3] On the other hand, Israel has found that after early nephrectomy, subsequent involvement of the other kidney is very rare.

In any case suspected of renal tuberculosis, the urine must be examined for tubercle bacilli, and since the tubercle bacilli occur in what Brown calls "showers," it is important that the examination be often repeated, and especially that it be done at times of exaggeration of symptoms. No entirely reliable staining method for differentiating smegma bacilli from the tubercle bacillus exists, hence the interest of the study of Brereton and Smith[4] as to the frequency of smegma bacilli in the urethra. They found them present in from 13 to 67 per cent. of individuals examined, according to the cleanliness of habit and the method of decolorization employed. To exclude these organisms in the search for tubercle bacilli, they recommend careful cleansing of the meatus and the use of catheterized urine. Although no good method of differentiation by staining exists, Brown and Petroff have found that smegma bacilli, after a fifteen-minute exposure to $\frac{N}{1}$ sodium hydrate (4 per cent.) can not be cultivated, whereas such treatment has little effect upon tubercle bacilli. The latter can not, however, be readily grown on ordinary media, but by the use of Petroff's egg-meat-juice-gentian-violet medium this is accomplished with fair regularity. Therefore, according to Brown, if fluid showing acid-fast organisms is exposed to $\frac{N}{1}$ sodium hydrate solution for fifteen minutes and then fails to give a growth in from ten to fourteen days on Petroff's medium, it is probable that the contained

[1] Policlinico, 1914, xxi, Sez. chir., 509.
[2] Journal of American Medical Association, 1915, lxiv, 886.
[3] Ibid., 226.
[4] American Journal of Medical Sciences, 1914, cxlviii, 267.

organisms are either not tubercle bacilli or that they are not alive. The most reliable, indeed the only positive test, however, is by guinea-pig inoculation; a negative result does not, of course, exclude tuberculosis.

For recovery of the tubercle bacilli from urine, Brown recommends the following procedure: Acidify the urine with 30 per cent. acetic acid, add 2 per cent. by volume of 5 per cent. tannic acid solution. Place in the ice-box twenty-four hours; centrifuge. The precipitate will now contain the tubercle bacilli. This precipitate may either be treated for fifteen minutes with $\frac{N}{1}$ sodium hydrate, neutralized and cultured on Petroff's medium, or it may be redissolved in dilute acetic acid, the solution again centrifuged and the precipitate placed on slides, fixed and stained.

That tubercle bacilli may occur in the urine in cases of pulmonary tuberculosis without there being renal tuberculosis has been previously suggested by the findings of Foulerton and Hillier, Cunningham, Bernstein, Rest and Kindberg. Brown finds that, of 104 cases of pulmonary tuberculosis, 10 per cent. gave positive results upon guinea-pig inoculation with the urine, although entirely free from any genito-urinary symptoms. Churchman[1] has found that the urine of cases with acute miliary tuberculosis will frequently show tubercle bacilli and has suggested that examination of the urine in suspected cases may aid in the diagnosis of this condition.

When the diagnosis of unilateral renal tuberculosis has been made, there is but little difference of opinion as to the proper course to pursue. Immediate nephrectomy is indicated. Involvement of the bladder is not a contra-indication to nephrectomy, since in 80 per cent. of cases the bladder symptoms subside following the operation. After nephrectomy, Brown, MacGowan, and others, recommend tuberculin therapy.

Hydronephrosis. Keith and Snowden[2] review the previous studies of the *effects of increased intra-ureteral pressure upon the secretion of urine.* It has been shown that a slight increase of ureteral pressure excites an increased output of urine from the kidney, but, as a rule, with lowered excretion of solids; greater pressure diminishes the urinary output, water as well as solids, and at about a pressure of 65 cm. of water the secretion of urine ceases. Keith and Snowden on six dogs did unilateral nephrectomy and subsequently produced a partial obstruction of the other ureter by means of a rubber band fastened around the ureter so as to cause a pressure in the ureter proximal to it of from 12 to 30 cm. of water. The consequence was a hydronephrosis with impaired renal function, as shown by polyuria, traces of albumin, diminished phthalein output, and delayed lactose excretion, but with no alteration in the degree of glycosuria after phlorizin; the non-protein

[1] American Journal of Medical Sciences, 1914, cxlviii, 722.
[2] Archives of Internal Medicine, 1915, xv, 239.

blood-nitrogen rose within two or three days and remained moderately high, 60 to 140 mgms. per 100 c.c., as a rule without toxic symptoms. This state continued in three of the animals until from the twenty-fourth to the thirty-fourth day, within which period they all developed suddenly a great diminution in their renal functional activity with rapid fall in the phthalein to a trace or to zero and rapid rise in the blood-nitrogen to from 220 to 395 mgms. Autopsy revealed a pyelonephritis as well as the hydronephrosis in all animals living more than ten days after operation.

Ghoreyeb[1] has studied the *effects of ureteral ligation* in the dog *upon the circulation of the kidney.* He finds that, upon microscopic examination of the kidney, during the first week after the ligation of one ureter, there may be noted distortion and compression of the renal vessels, with swelling and degeneration of the renal epithelium. If, during the first week, the renal pelvis is opened and the pressure relieved, the renal circulation becomes quite or almost normal. After a week, however, cicatricial changes have set in leading to dilatation of the tubules, compression of the vessels, and proliferative changes in the glomerular tufts; there is associated hypertrophy of the other kidney. At this stage, relief of the intrapelvic pressure by opening the renal pelvis will no longer restore the renal circulation to normal.

Barber and Draper[2] have studied *renal infection secondary to experimental bladder infection.* They find that if they traumatize the ureter sufficiently to interrupt ureteral peristalsis but allow the ureterovesical valves to remain intact, although some degree of hydronephrosis develops in 75 per cent. of the cases, infection of the kidney does not follow the introduction of infected foreign bodies into the bladder. Likewise, cutting of the ureterovesical valve without injury to the ureter or interference with its peristalsis causes no renal infection subsequent to bladder infection. If, however, the ureters be paralyzed by traumatism, and also the ureterovesical valves be cut, infection of the bladder is followed promptly by renal infection in 50 per cent. of the experiments.

As an instance of the possible danger of injection of silver salts into the renal pelvis for diagnostic purposes, Buerger[3] reports 2 cases from his own experience in which extensive necrosis of the renal parenchyma followed careful injection of argyrol in 1 case, collargol in the other, into the pelvis of a hydronephrotic kidney. Cystoscopists differ as to the likelihood of this accident occurring provided the fluid be permitted to flow in by gravity without any undue force being employed for the injection. It is conceded that those kidneys with extensive ulceration of the pelvis are probably more susceptible to injury in this way.

[1] Journal of Experimental Medicine, 1914, xx, 191.
[2] Journal of American Medical Association, 1915, lxiv, 205.
[3] Surgery, Gynecology and Obstetrics, 1914, xix, 536.

Coryell,[1] reporting a series of cases from the Mayo Clinic, notes the greater tendency of *renal cancer* to occur in association with renal calculi. Thus, since 1905, of 104 kidneys operated upon with calculi, 9, or 6.5 per cent., showed gross or histological changes considered evidence of cancer. During the same period only six other nephrectomies were done for renal cancer without calculi. Therefore, of their 15 cases of renal cancer, 9 were associated with calculi while 6 were not.

Rosenbloom[2] has published the *chemical analysis of twenty-six renal calculi,* and in all but two finds a predominance of calcium salts, especially the oxalate. In only two stones was uric acid the chief constituent. He suggests that our ordinary alkaline therapy, recommended because it renders uric acid more soluble, would render calcium salt less soluble, and, in view of the predominance of the latter in the calculi, he has suggested that the use of such therapy seems of questionable propriety, at least until the nature of the precipitated salts is determined in a given case. The free use of a distilled or relatively salt-free water would be a safer procedure.

Lund[3] reports his results from *Rovsing's operation* in 4 cases of *congenital polycystic kidneys.* The operation consists of exposing the kidney, puncturing all accessible cysts, delivering the kidney, now reduced in size, and puncturing so far as possible the remaining cysts. Rovsing had reported marked clinical improvement in 3 cases. To these Lund adds 4 of his own, which from one and one-half to three years after operation still show improvement. Mickaniewski[4] avoids operation in these cases except for the relief of intolerable pain, evidences of suppuration in the cysts, persistent hematuria or anuria. Under these circumstances, he recommends the more extensive operation of decapsulation and excision of the larger cysts. He does not report definitely the results in any series of cases.

Wade[5] reports the second case on record of *spontaneous rupture of both kidneys* with secondary perirenal hemorrhage. The incident occurred in the course of an acute toxic nephritis, apparently as the result of the intense swelling of the kidneys. The literature of rupture of the kidney was recently thoroughly reviewed by Speese.[6] Two spontaneous, but unilateral, cases of rupture are reported by Baggerd.[7] The symptoms noted in these cases are sudden, intense pain in the region of the kidney, sometimes with signs of severe internal hemorrhage and sometimes with the development of a tumor in the renal region.

[1] Bulletin of Johns Hopkins Hospital, 1915, xxvi, 93.
[2] Journal of American Medical Association, 1915, lxv, 161.
[3] Ibid., 1914, lxiii, 1083.   [4] Jour. d'Urologie, 1914, v, 603.
[5] Journal of Medical Research, 1915, xxxii, 419.
[6] Surgery, Gynecology and Obstetrics, 1913, xvi, 571.
[7] Beitr. z. klin. Chir., 1914, xci, 454.

GENITO-URINARY DISEASES.

By CHARLES W. BONNEY, M.D.

DISEASES OF THE KIDNEYS AND URETERS.

The Control of Hemorrhage Following Nephrotomy. Secondary hemorrhage after nephrotomy is a sequel which renders the operation one of the most dangerous in surgery, and it is one which will sometimes occur despite the greatest precautions to prevent it and irrespective of any improvement of technic which has thus far been made. One of the early procedures consisted in carrying sutures deeply through the substance of the kidney. This, however, not only occasionally failed to fulfil the purpose for which it was employed, but also was shown to inflict considerable damage upon the renal parenchyma. In a recent contribution to this subject A. A. Tschaika,[1] of Petrograd, reviews the various procedures employed and points out how the deep suture, when used experimentally upon animals, gave rise to tissue changes, consisting of dilatation of the tubules followed by degenerative and atrophic changes, so that functioning kidney substance was converted into scar tissue. The mattress suture, which seemed best adapted for the control of hemorrhage, did more damage than did simple through-and-through suture. It has been the custom of Federoff, in whose clinic Tschaika worked, to tampon the renal incision with perirenal fat, a procedure which clinically proved satisfactory. When applied to animals, Tschaika found that the fat underwent certain histological alterations and did not produce those marked changes in the renal tissue which are caused by deep sutures. The animal experimentation also proved that the procedure has distinct hemostatic value. It seems to me that this method is deserving of further trial. Although Federoff used it in only 6 cases, he is a firm believer in its efficacy. Perhaps further experiments upon animals will serve to place it upon a more firmly established basis.

Nephrectomy for Bilateral Lesions. This topic was discussed at the third meeting of the International Association for Urology held in Berlin last year. Naturally, the greatest interest attaches to tuberculous cases. Legueu,[2] of Paris, who took part in this symposium presented an analysis of 93 cases of renal tuberculosis in which one kidney

[1] Deutsche Zeitschrift f. Chirurgie, November, 1914.
[2] Folia Urologica, March, 1915.

had been removed. Out of this number there were 13 postoperative deaths, a large proportion of which resulted from the insufficiency of the remaining kidney. It was possible to trace 58 of the patients who eventually succumbed. The greater number of them died between two and three years after the operation. The reporter believes that the result of operation in these cases must be determined by two factors, namely, its effect upon the bladder and its effect upon the general health. Concerning the first, information was obtained in 27 cases. Out of this number, in 5 there was no improvement whatever. In 6, marked benefit was experienced after the operation, though it did not last. In 13, improvement of considerable duration followed, and in 4 a permanent improvement seemed to have been obtained. As the urine was diverted either into the bowel or through a lumbar nephrotomy opening in 2 of these 4 cases, it was impossible to tell just what effect the operation had upon the bladder. With reference to the general condition, no improvement followed operation in 3 cases. Temporary improvement was noted in 4. In 35 there was such improvement that the patients were able to return to work, having gained in weight and strength. Among this number the condition of the bladder was most variable. Eight patients seemed to have been permanently cured. From a study of these cases the reporter concluded that removal of the more diseased kidney had a good effect upon the other organ.

In the discussion which followed, Brongersma agreed with Legueu that the progress of the disease seemed to be arrested after removal of the more diseased kidney, but did not consider operation indicated except in those cases in which the morbid process in one kidney was far advanced and only beginning in the other. This would seem to be a very good working rule to follow. Some difficulty, however, might be met with in determining the exact condition, both structurally and functionally, of the two kidneys, particularly if it were impossible to catheterize the ureters. Sometimes beginning tuberculosis will give rise to severe hemorrhage and a high pus content in the urine, and the physical condition of the kidney may fail to correspond to its functional capacity. It is interesting to note that Rovsing, who also took part in the discussion, reiterated his belief that the urea test applied to urine obtained separately from each kidney is the most trustworthy guide in determining functional capacity. Kuemmell still pins his faith to cryoscopy of the blood. He has become less conservative of late years, he states, in regard to surgical intervention in cases of bilateral tuberculosis, for experience has taught him that operation will often do much good.

Injury to the Duodenum Following Nephrectomy. In the last review, reference was made to William J. Mayo's[1] paper concerning this acci-

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[1] Journal of the American Medical Association, March 20, 1915.

dent. He has made another contribution to the subject, reporting a case in which he did a transperitoneal closure of the fistula. It was a case in which a stone had been removed from the left kidney, and the right kidney had been removed, both operations having been done through a posterior lateral incision, an interval of about two months having been allowed between them. The wound on the left side healed by first intention and was sound before the second operation was done. Upon the right side, also, primary union took place. During the fourth week of convalescence a sinus formed in the wound and persisted for more than four months, when the patient was again seen by Dr. Mayo. At that time he was somewhat septic and running an evening temperature which ranged from 101° to 103° F. He did not feel well, had lost flesh and was subject to chills. An improvement gradually took place so that he was able to be up and about, but the sinus continued to discharge a mucopurulent substance.

Under general anesthesia the sinus was opened wide enough so that the finger could be introduced, and a strip of iodoform gauze was inserted for drainage. On the following day there was a considerable discharge of light yellow fluid. On the second day the gauze was removed, whereupon a profuse discharge of bile, pancreatic and duodenal secretion, together with some small pieces of food, took place. This rupture made it plain that an opening into the duodenum had been made. The patient was prepared for operation immediately. The abdomen was opened by a right rectus incision. The hepatic flexure and the transverse colon were drawn down, the liver and gallbladder drawn up, and an incision carried through the peritoneum external to the duodenum, beginning at the level of the papilla of the common duct and extending well around toward the spine. In this wound the duodenum was carefully loosened from its posterior attachments until the fistula was plainly brought to view. The opening, which was big enough to admit the end of the finger, was sutured transversely with chromic catgut and then with an interrupted suture of intestinal silk, after which the omentum was drawn over the line of suture. Drainage was established by means of rubber tissue. The patient made an excellent recovery.

The author believes that the fistula was the result of a low-grade infection, and that in the second operation his manipulation caused the separation of a necrotic area in the duodenum. He states that the method of approach used in this case is easy and satisfactory, and expresses the opinion that it will be the method of choice. It appeals to me as being anatomically correct.

Floating Kidney. Among the papers published during the last year upon this subject, one by W. V. Simon,[1] of Breslau, based upon 48

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[1] Zeitschrift f. Urologie, Bd. 8, No. 8.

cases which occurred in the University Clinic there, is of special interest. Of this number, 40 were in women and 8 in men. The greater number were between the ages of twenty and forty-five years. There were 4 bilateral cases. Twelve gave a history of trauma either direct or indirect. In more than one-half of the series no etiological factor could be determined. Ptosis of other organs occurred in 12, and in 6 there was accompanying appendicitis. In 9 cases there were signs of intermittent hydronephrosis, in 18 others there were attacks of cramp, and in 12 cases nervous or psychic disturbances were also present. In 17 cases the treatment was conservative. It was possible to get recent information from 8 of these patients. It was found that 3 of them were cured, 2 improved and 3 unimproved. Nephropexy was performed in 19 cases, and, of the patients so treated, the after-result was learned in 16 cases. Four of them were cured, 5 improved, 5 unimproved and 2 died. One patient succumbed from hemorrhage after the operation and it is believed that she was a hemophilic. One died a year later of uremia, another patient who had severe secondary hemorrhage had a nephrectomy performed.

The technic employed was an oblique lumbar incision with delivery of the kidney, splitting of its capsule, and fixation of the upper pole to the twelfth rib, followed by suture of the capsule to the muscles and fascia. Drainage by means of tube or gauze was frequently practised. The after-treatment consisted of from 18 to 20 days' rest in bed. In discussing the indications for operation, the author calls attention to the comparatively unsatisfactory results obtained by nephropexy in his series of cases. The majority of the patients who were either cured or improved were obliged to wear some kind of a support afterward in order to be comfortable. He considers the greatest difficulty in deciding upon operation to be the determination whether the symptoms present are really due to malposition of the kidney. Under no circumstance does he advise operation until all therapeutic measures have proved useless, and until it has been positively determined that other conditions, such as appendicitis or disturbances of the genital organs, are not responsible for the symptoms. Of course, cases associated with kink of the ureter and intermittent hydronephrosis constitute an exception to this rule. He warns us especially against the employment of nephropexy in patients who present serious nervous disturbances, and also in those who are hysterical. In his series of cases there is not one instance in which nervous symptoms were relieved by operation. In cases in which exploratory laparotomy has been done with the hope of finding some condition to explain the obscure symptoms, and a movable kidney found which had escaped detection before, then he believes that a transperitoneal nephropexy should be done, not only because such an operation may be followed by relief of the symptoms, but also because it may possibly save the patient from

the physical and psychical shock of a subsequent operation, which might be deemed necessary after the kidney had become palpable through the parietes.

Hydronephrosis. A very thorough study of hydronephrosis also has been made by Simon,[1] of Breslau, his paper being based upon 20 cases which were treated in Kuettner's clinic. Ten of these cases occurred in men and 10 in women, the series thus differing from those which have been reported by other surgeons in which there was a preponderance of female patients. In discussing the etiology of this affection, the author points out that any condition which interferes with the outflow of urine may give rise to its retention within the pelvis of the kidney, it matters not in what part of the urinary tract the obstruction be situated, or whether it be due to a congenital or acquired condition or a combination of the two; as, for instance, the presence of anomalous vessels which, by lengthening the pedicle of the kidney, allow it to become displaced downward. He discusses especially the conditions confined to the kidney and ureter, for they are the only ones which make it necessary to direct treatment to the kidney itself. An obstruction of this kind may be caused by a ureter which is given off abnormally high and at an acute angle from the renal pelvis, or by contraction of the ureteral walls following inflammation, or by pressure produced by tumors. In congenital dystopia of the kidney, too, the ureter may become kinked and cause interference with the outflow of the urine, this being the condition which certainly was present in one of the cases, and also probably in another. The author remarks that, in some instances, the determination of the exact cause is considerably more difficult for the surgeon than it is for the pathological anatomist.

With reference to symptomatology, he states that many of the patients first sought advice when they discovered an abdominal tumor of considerable size, a circumstance which goes to show that as long as the hydronephrotic kidney remains uninfected it may not give rise to any symptoms. A striking example of this fact was afforded by the case of a six-year-old boy, who was first known to be afflicted with hydronephrosis when the latter was ruptured by an injury. He had not had the slightest symptoms before. Other patients came to the clinic because they had been troubled with pain, which varied in frequency and intensity in different cases. Usually it was located near the tumor, either in the abdomen or in the lumbar region; ofttimes it radiated to the genital organs, in most cases it was intermittent, occurring as attacks of cramp; sometimes it was characterized by the patients as a dull, aching pain. From these considerations the author believes that hydronephroses are usually, if not always, open in their early stages, and that pain appears only when there is some interference

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[1] Zeitschrift f. Urologie, November, 1914.

with the outflow of their contents. Naturally, it is difficult to tell from clinical examination whether a given hydronephrosis is open or closed, as it may close only to open again spontaneously within a short time. Chills and fever bespeak infection. Fever occurred in 4 of the 20 cases reported. In 2 others, leukocytes and casts were found in the urine, although the patients had no symptoms of infection. Gastro-intestinal disturbances were relatively frequent, the most severe form being vomiting, which occurred at the time of the crisis. Organic stomach disease could not be demonstrated in a single case.

Conservative treatment is recommended in those instances in which only mild disturbances are experienced and in which only slight enlargement of the kidney has taken place. In cases in which a movable kidney seems to be the cause of the trouble, and in which the hydronephrotic symptoms are purely intermittent, being dependent upon transitory interference with the outflow of fluid, it is advisable to try to keep the kidney in place by mechanical means. The opinion is expressed that in all other cases none but urgent reasons should influence one to refrain from operation. Conservative procedures will suffice for all cases provided they are seen early enough, nephrectomy being reserved for the late cases in which very little functionating kidney tissue is left. Seventeen of the 20 patients were operated upon. The conservative plastic operation was done three times, nephrectomy nine times, and extirpation after suture and puncture of the sac five times. Two of the patients died as the result of the operation.

Polycystic Kidney. An exhaustive study of polycystic kidney has been made by Charles E. Barnett,[1] who concludes that the condition, both bilateral and unilateral, is much more common than previous statistics show it to be. The total number of cases which he collected is 251, of which 150 were bilateral and 101 unilateral. Perhaps, if further data could be secured concerning the kidney supposedly not involved, it might be found that cystic changes were already beginning therein, as the condition is, in all probability, a congenital one caused by the faulty union of the upper and lower portions of the urinary tract. Dr. Barnett, however, seems to think that there may be several causes for the condition.

Another interesting paper on the subject is that of F. B. Lund,[2] of Boston, who not only reviews the pathology and symptomatology of the condition carefully, but also reports 4 cases in which he operated. He commends Rovsing's operation, which consists of exposing the kidney through a lumbar incision and puncturing the cysts. He states that the size of the organ becomes so reduced after the superficial cysts have been punctured that it can be drawn farther out of the

[1] Surgery, Gynecology and Obstetrics, December, 1914.
[2] Journal of the American Medical Association, September 26, 1914.

wound and other cysts thus reached and evacuated. Healthy kidney tissue should be avoided, as considerable hemorrhage will result if it be wounded to any extent.

The author's results confirm Rovsing's statement as to the disappearance of pain and improvement in renal function, and he believes it to be the best method of treating the condition. It is advised that only one kidney be operated upon at a time.

Carcinoma of the Kidney Associated with Calculus. In this review for 1913, reference was made to a series of 11 cases of carcinoma of the kidney, in 7 of which there was a history of renal calculus. During the last year another contribution to the subject was made by J. R. Coryell,[1] of Rochester, Minnesota. Since April, 1905, the Mayos have removed 140 kidneys in which there were calculi, and out of this number there were 9 which showed carcinomatous changes. During the same period they also did six nephrectomies for carcinoma of the kidney, one of which was metastatic. Thus there were 9 cases of carcinoma associated with lithiasis and 5 without lithiasis, which seems to be about the same proportion as that in other forms of carcinoma which are superimposed upon chronic irritation. In all the specimens examined, evidences of inflammation were found in some part of the kidney, being of different degrees in different specimens. Some showed gradual changes from normal tissue to inflammation, some showed hyperplasia, and some beginning malignancy, so that Coryell concluded that the irritation produced by the calculi was directly responsible for the development of malignancy.

Anuria. The etiological and surgical phases of this condition were carefully considered by Hugh Cabot,[2] of Boston, in a recent address before the Mississippi Valley Medical Association. He recognizes three types, the neuropathic, the destructive and the obstructive. The first type, though not as serious as the other two, is certainly quite as interesting, but care should be taken not to make this diagnosis until every gross organic lesion capable of producing the condition has been excluded. An interesting case which came under the observation of the author was that of a hospital nurse, aged twenty-five years, who was apparently in excellent health. While on duty she was suddenly seized with severe pain in the left lumbar region, accompanied by nausea and vomiting, and some elevation of temperature, though only slight acceleration of pulse. At the beginning of the attack she voided about four ounces of urine, which, upon examination, proved to be normal in every respect. Suppression of urine, however, was complete. A careful physical examination failed to reveal anything which would account for the attack. Ureteral catheters were

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[1] Bulletin of Johns Hopkins Hospital, April, 1915.
[2] Lancet-Clinic, February 6, 1915.

passed to the pelvis of both kidneys without any difficulty, but no urine came away. In the absence of any demonstrable cause the diagnosis of hysteria was made, and proved to be correct by the course of events. The patient afterward had two similar attacks, in one of which the left kidney was cut down upon and found to be normal. In discussing the diagnosis, the author very rightly attributes great importance to expert cystoscopic and x-ray work, stating that physical examination without these helps will often result in the performance of an unnecessary operation. With the exception of the neuropathic cases the only ones which he considers positively inoperable are those due to bilateral destructive lesions. He truly, even if sarcastically, remarks that while the hysterical cases get well after operation, this surgical success is of a kind that one should endeavor to avoid. His opinion concerning operation in cases of corrosive sublimate poisoning which, unfortunately, has received so much exploitation in the lay press, is interesting. So far as the anuria is concerned the whole question hinges upon the amount of kidney tissue which has been destroyed by the poison and that is a thing about which no one can make hard-and-fast statements. The judgment of the surgeon in each and every case is the only thing that can be depended upon, and, from the experience thus far recorded, it would seem the part of wisdom not to intervene with the hope of really accomplishing much. Dr. Cabot reminds us that damage to the intestinal tract itself in these cases is usually sufficient to cause death even if there were no damage to the kidneys. The same thing, of course, might be stated with reference to poisoning by arsenic and its compounds, particularly salvarsan and neosalvarsan, which is of special interest at the present time. In one fatal case which I saw there was severe toxic nephritis; but as there was also great disturbance of cerebellar function and probably extensive destruction of the liver cells, no thought was given to a decapsulation operation or a nephrotomy. Bilateral decapsulation in acute nephritis the author believes to be an operation which has a certain place in the treatment of desperate cases, for the reason that there are a sufficient number of successful cases on record to make the procedure justifiable under some conditions. Here again the judgment of the surgeon is the thing that counts. Naturally, calculous anuria is considered the form in which the best results are to be expected from surgery. In discussing the type of operation, the opinion is expressed that nephrotomy should be avoided whenever possible, and in this opinion I heartily concur, for I consider it to be one of the most dangerous operations in surgery. Ureterotomy, with extraction of the stone and suture of the ureter, is considered the operation of election, but when certain data cannot be obtained, as, for instance, the location of the calculus by the x-ray, pyelotomy will afford relief and sometimes allow the passage of the stone. The author considers it to be an easy, rapid and safe operation,

much preferable to nephrotomy. In case of bilateral obstruction, simultaneous operation upon both sides is advised. In closing his address, Dr. Cabot made a plea for the more general use of all the diagnostic measures at our disposal.

The Treatment of Chronic Pyelitis. J. T. Geraghty,[1] of Baltimore, reports brilliant results from *renal lavage* in cases of chronic pyelitis. He states that he has returned to the use of silver nitrate after having employed various other drugs. Now he uses nothing else except a weak formaldehyde solution, which he prefers in cases in which there is a mild hydronephrosis. In such cases the catheter is pushed up into the pelvis of the kidney and the urine allowed to drain away before the medicinal solution is injected. This method, first introduced by Casper, seems ideal in treating non-tuberculous pyelitis. It has been found very efficacious in colon bacillus infection. Geraghty states that the organism causing the infection has very little to do with the prognosis.

Ureteral Calculi. In this review of two years ago, mention was made of the work which Bransford Lewis had done in removing ureteral calculi by cystoscopic methods. In a more recent contribution, Dr. Lewis reports a number of other cases which he has treated satisfactorily in the same manner. Further experience has convinced him of the great value of the method, which he states has developed into a "tangible and serviceable reality," and has proved its efficacy in a sufficient number of instances to justify its general recognition and its adoption as the method of choice in all appropriate cases. He recognizes its limitations, however, and states that accurate diagnosis and good judgment are requisite in determining its applicability to a given case. Even when there is some doubt as to the result, he believes that the method should be tried, as it will do no harm and may save the patient from a cutting operation. The injection of oil through a ureteral catheter and attempts to dislodge the calculus with the catheter have not always proved successful. So he has been obliged to split the ureteral orifice in some cases and then introduce a forceps with which the stone is grasped and removed. If there be a constriction high up in the ureter beyond the reach of the metal accessories, flexible dilating bougies must be depended upon for widening the ureter and thereby favoring dislodgement of the stone.

Geraghty and Hinman[2] attribute special diagnostic value to the wax-tipped ureteral catheter, and recommend its more frequent employment. In 6 out of 36 cases which have come under their observation in the last two years, they succeeded in locating a stone with this instrument after other methods had failed, and when repeated x-ray examinations

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[1] Journal of the American Medical Association, December 19, 1914.

[2] Surgery, Gynecology and Obstetrics, April, 1915.

had been negative. With reference to the latter, they state that a very large percentage of calculi may fail to be detected by it even when it is used by the most expert. Owing to the frequency of extra-ureteral shadows near the pelvic portion of the ureter, they believe that a diagnosis of calculus in this region should not be made from the x-ray picture, unless other evidence of its presence can be obtained.

As to treatment, they state that unless the stone is completely blocking the ureter, or giving rise to oft-repeated colic, simple manipulative measures should first be resorted to. When stones lie beyond the juxta-vesical portion, attempts to dislodge them with the ureteral catheter or by the injection of oil have proved successful in some cases, as has also the use of the thermocatheter, which they believe relaxes the ureteral walls. Calculi in the vesical portion of the ureter they have found, as a rule, to be amenable to cystoscopic procedures.

DISEASES OF THE BLADDER.

Malignant Disease of the Bladder. It is quite in keeping with the general trend of modern surgery to diagnosticate malignant disease in its incipiency, thereby making it more amenable to curative treatment, that genito-urinary surgeons should have given serious thought to its detection in those organs which comprise their special field. Perhaps their earnest efforts have been inspired, in part at least, by a consideration of the truly lamentable results that have followed their most conscientious attempts to cure the unfortunate subjects who came under their observation at a time when radical surgery could offer little hope of benefit. It often happens that too little importance is attached to initial symptoms, with the result that patients are liable to go on until extensive infiltration makes complete removal of the neoplasm extremely difficult and dangerous, and reduces to a minimum the chances of cure.

In a recent paper on cancer of the bladder, J. Bentley Squier[1] states that nowhere in the field of malignancy have the end-results been so discouraging, and this statement is one which I believe may well be allowed to pass unchallenged. In discussing its early diagnosis, he makes a strong plea to the general practitioner to bear in mind that an attack of painless transient hematuria, which may subside as unexpectedly as it occurred, and which may not be followed by any other symptom for the time being, may be a sign of actual or potential malignant disease of the bladder, and that the occurrence of such an attack always demands the most careful investigation. In cases of this kind the cystoscope in the hands of an expert will prove of the utmost value in determining whether the hemorrhage comes from the bladder, and

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[1] American Journal of Surgery, July, 1915.

it would be most fortunate indeed, if every patient so affected could be subjected to such an examination. This point has also been well taken by Edwin Beer.[1] Several observations are made by these two authors to which it may be well to call attention here. Both believe that cystoscopic examination alone should not be depended upon if there is any doubt as to the nature of the lesion detected, and consider that bimanual examination should always be resorted to. A well-defined indurated mass felt above the prostate upon rectal examination bespeaks the presence of malignancy, even though the cystoscopic picture points toward the presence of a benign growth. As to the value of microscopic examination of fragments of tissue removed through the operating cystoscope or passed spontaneously with the urine, the authors differ in opinion. I am inclined to believe with Dr. Squier that in these cases, of all others, results obtained therefrom are liable to be misleading; certainly, I do not consider them equal in value to those obtained from sectioning neoplasms in other parts of the body, particularly those in the mammary gland.

Dr. Squier very appropriately calls attention to the transitional nature of these tumors, in that one which has all the structural characteristics of a benign growth in one part may exhibit areas superficially or frankly malignant in another part. An interesting question arises as to the possible influence which simple ulcer of the bladder may have in the production of cancer. In this review, some years ago, two cases of the kind were referred to which had occurred in the practice of Buerger. In a more recent communication, Guy L. Hunner[2] has reported 8 others in which superficial ulcers were found in the vertex or summit of the viscus. None of them was more than a half-centimeter in diameter, and their chief characteristic seemed to be their superficiality. Hunner states that such ulcers may easily escape detection. The first thing to be noticed may be certain whitish scar-like areas, close to which may be seen patches of hyperemia, which bleed when touched with an instrument or the beak of the cystoscope, and thus reveal the true character of the lesion. Some of them, however, appear as well-defined ulcerations.

In his Chairman's Address at the last Atlantic City meeting of the American Medical Association, Arthur L. Chute[3] makes a plea for more extensive operation for cancer of the bladder. He likewise insists upon the desirability of early diagnosis and early radical removal of beginning neoplasms. In well-advanced cases he contends that total cystectomy is the only surgical measure which at present offers any hope of cure. In addition to this, he believes that dissection of the lymphatics of the pelvis must supplement the removal of the diseased bladder. In this

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[1] American Journal of Surgery, July, 1915.
[2] Boston Medical and Surgical Journal, May 6, 1915.
[3] Journal of the American Medical Association, December 26, 1914.

connection there is ample opportunity for further investigation concerning the lymph supply and lymph distribution of the bladder. In 10 out of 29 cases the neoplasm was situated so close to the outlet of the bladder as to make its removal impossible without destroying the outlet, a circumstance which lends much weight to the author's recommendation of total cystectomy, stupendous operation though it be.

It seems to me that the greatest good will result from the education of the laity, and, to a lesser extent, of the profession to a better understanding of the importance attaching to the early manifestation of vesical neoplasms, particularly urinary hemorrhage. There is a time when any new growth may be removed with safety and assurance of cure. The crux of the whole situation is to get hold of the patients and operate upon them at that time. With reference to the advanced cases, I cannot but feel, as Dr. Chute feels, that complete removal of the bladder and the contiguous lymph-bearing areas is the only thing that will offer the slightest chance of permanent cure.

At the last meeting of the American Urological Association, J. Bentley Squier quoted his experience with *radium* in the treatment of bladder tumors, and expressed the opinion that none but benign papillomata can be cured by this agent. He thinks it possible, however, to control certain malignant cases by its employment.

High Frequency Current in the Treatment of Benign Papillomata of the Bladder. Edwin Beer,[1] who introduced this method five years ago, has published another paper giving his conclusions as to its place and value. He states that results have been highly satisfactory. He prefers the Oudin to the d'Arsonval current for the reason that the former possesses an explosive action which largely prevents the detachment of the tumor by its partially devitalized pedicle, and also because it has a more marked focal action at the point of application and not so much remote action. He states that the large size of a papilloma is not a contra-indication to the treatment, the latter being constituted solely by inaccessibility of the growth, intolerance of the cystoscope, or severe hemorrhage following its introduction. Malignant growths, of course, are better not treated by this method. The author's first patients have remained well for more than four years.

In reviewing his experiences with the fulguration treatment, E. L. Keyes, Jr.,[2] mentions some of the untoward results which occur. There were 2 cases of serious infection, and in 3 cases retention of urine took place during the second week, being due to the formation of large blood clots. He states that he knows of two deaths which occurred in the practice of other surgeons. He also mentions a case in which the operator was knocked senseless by using the direct current and the indirect current

[1] Annals of Surgery, June, 1915.
[2] Surgery, Gynecology and Obstetrics, August, 1915.

for the source of illumination and fulguration respectively. He remarked that he did not know what happened to the patient. With reference to recurrences, he states that there were several at the site of the original growths, and that in 1 case the patient developed a papilloma in another part of the bladder. When more than two or three tumors are present, he considers relapse probable. Keyes uses 1 to 2000 quinine bisulphate as a medium for cystoscopy, and thinks that it possesses decided antiseptic properties.

B. A. Thomas[1] also reports 2 cases of recurrence after fulguration. In 1 papilloma reappeared three times.

Geraghty[2] also recorded his experience at the last meeting of the American Urological Association where the above-named reports were made. He has found it possible to destroy the malignant as we as the benign papillomata, although the former did not yield nearly as quickly to the treatment as did the latter. Consequently he considers those tumors which resist sparking to be very suspicious. He reports a remarkable case in which 75 applications were administered during the period of nine months required to bring about removal of the growth. In 3 of his cases of malignant papillomata metastases developed in other parts of the body and caused the death of the patients although there was no recurrence in the bladder.

Lactic Acid Bacilli in the Treatment of Cystitis. An interesting contribution to this subject has been made by John R. Caulk,[3] of St. Louis, who not only reviews the etiology, histology, symptomatology and diagnosis, but also makes a valuable addition to the methods of treatment. His paper is based on the study of a case in which surgical and endovesical treatment had failed to give permanent relief, but which yielded readily to intravesical injections of an emulsion of Bulgarian bacilli. The dose was 18,000 bacteria. An injection was made every day for a week, and then every second day for ten days. Marked improvement was noted at the end of 48 hours after the first injection, the hematuria having diminished and the patient being free from pain. She could also hold her urine for an hour, and was voiding large amounts of calcareous material. Twenty-three days after the beginning of the treatment the bladder was found to be entirely free from incrustation, and no evidences of inflammation could be found except behind the trigonum, where there was a healing ulcer. The urine was examined repeatedly and at the end of two months it had become clear. At this time the patient was able to hold her urine for seven hours and had no subjective symptoms whatsoever. She had gained markedly in weight.

The rationale of this treatment consists in implanting an acid-producing

[1] Surgery, Gynecology and Obstetrics, August, 1915.   [2] Ibid.
[3] Transactions of the American Association of Genito-urinary Surgeons, 1914.

bacterium which will so multiply within the bladder as to produce enough acid to change the reaction of the urine. The author states that the bacillus used is capable of producing as high as 3 per cent. lactic acid. The advantage of this treatment over the injection of any acid itself lies in the fact that, once the bacilli have become thoroughly implanted in the bladder, they constantly produce acid and thus, in the course of time, render impossible the growth of the pathogenic organisms which require an alkaline medium; whereas the injection of acid can be only temporary in its effect and nowise exert any permanent action upon the alkali-producing bacteria. That the treatment is harmless the author has demonstrated both clinically and experimentally.

In the case of the patient first treated, it was found that the Bulgarian bacilli were completely destroyed after one bichloride of mercury irrigation. In experiments upon animals it was demonstrated that no signs of inflammation whatever followed the introduction of the bacilli, though traumatism had been inflicted upon the bladder.

The author has also used this treatment in several cases of alkaline cystitis and in 1 case of ammoniacal suprapubic wound, the results being very satisfactory in all.

This is a valuable contribution to the subject of incrusted cystitis, which heretofore has been notoriously intractable to all therapeutic measures, and it is to be hoped that further use of Dr. Caulk's method will show it to be as valuable in other cases as it was in his.

Marion[1] has also treated cases of tuberculous cystitis by injections of lactic acid bacilli. Before using it in man he made some experiments upon guinea-pigs and rabbits, inoculating them with tubercle bacilli directly into the parenchyma of the lung. Keeping two animals as controls, he injected a pure culture of lactic acid bacilli into the others. After a month the animals were killed and examined. Those which did not receive the lactic acid bacillus injection showed a typical tuberculous cavity in the lung and, moreover, the guinea-pigs had a generalized tuberculosis. Those which had received the lactic acid bacillus injection in the lung, although they showed a generalized tuberculosis, did not have any cavities in the lung, calcification having taken place around the site of the injection. His first therapeutic experience was in the case of patients who had previously had a kidney removed for tuberculosis and in whom the vesical symptoms did not clear up. Afterward he tried it upon patients who had not been subjected to operation, with the hope that it might relieve their vesical symptoms. After a certain number of intravesical injections every patient was improved, some of them so much so that they considered themselves

[1] Bull. Mémoires de la Société de Chirurgie de Paris, 1914, No. 19; also Journal d'Urologie, June 15, 1915.

cured. In 5 cases in which operation had not been done, there was distinct amelioration.

The cultures of the bacilli were made in tubes of skimmed milk and sterilized at 120° C. and then left for twelve hours in an autoclave at a temperature of 37°. Of this preparation, from 10 to 15 c.c. were injected into the bladder three times weekly. The reaction to the injection was different in different patients. Some of them did not experience any pain whatsoever, and some even felt relief after the first injection. Others felt a sensation of warmth, sometimes amounting to distinct pain. The author believes that these different manifestations were due to a different percentage of lactic acid in the different tubes, as it varied from 7 to 15 grams per thousand. Marion considers this method of medication superior to any other now at our disposal in the treatment of tuberculosis of the bladder. He believes also that it may be very useful in other forms of cystitis. He states that its employment in lumbar fistula following nephrectomy for tuberculosis seems perfectly logical.

Diverticula of the Bladder. William E. Lower,[1] of Cleveland, discusses the operative treatment of diverticulum of the bladder and reports 7 cases which have occurred in his practice. In his earlier cases he states that he divided the bladder down to the diverticulum, separated the attachment of the latter from the bladder and then endeavored to dissect it away. The results following this method were not satisfactory, and in 1 of the cases recurrence took place owing to incomplete removal of the mucous membrane. In 2 other cases in which the diverticulum was not deep, it was turned inside out, then brought up into the cavity of the bladder, excised and its attachment to the vesical wall closed with chromic catgut.

The method which Lower now favors consists in converting the sac into a solid tumor, according to the technic of Cabot, and then dissecting it away. The author considers this method somewhat easier than that of Lerche in which a small rubber bag is inserted into the diverticulum and inflated, and which was fully described and commented upon in this review for 1912. In 3 cases which were operated upon, the sacs were tightly packed with narrow strips of gauze. In 1 of these cases the diverticulum was multiple, having four separate sacs. The functional results in 2 of these cases were highly satisfactory, but in the other 1 there is still some residual urine which the author believes to be due to enlargement of the prostate.

Particularly interesting are the author's findings concerning the injection of collargol and the application of the x-rays, for this combined method not only gives a good idea of the relations of the diverticulum,

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[1] Journal of the American Medical Association, December 5, 1914.

but also enables one to form a definite opinion as to the value of excision. In 3 of his cases he was so fortunate as to get röntgenograms after the operations. The steps of the operation are as follows: Nitrous oxide-oxygen anesthesia with local infiltration of novocain is employed, and a transverse incision is made through the skin and fascia. Then the recti are separated and the bladder is brought up with curved forceps and dissected free from the peritoneum. The diverticulum is tightly packed, then with the fingers inside the bladder, the index finger in the opening of the diverticulum and the thumb on its outside, the attachment to the bladder is exposed and divided. The bladder is then drawn away from the diverticulum and, while traction is being made on the latter, it is freed from the surrounding tissues. In some cases this last procedure was not necessary, as the diverticulum could be brought up first and the dissection from the attachment to the bladder made afterward.

Cystography. Zuckerkandl[1] has found cystography carried out by injecting the bladder with collargol and then taking an x-ray picture of it to be of service in those cases of vesical tumor in which it is difficult, or impossible, to pass the cystoscope. The collargol shadow frequently includes the neoplastic growths and conceals them, a circumstance upon which the value of the author's method depends. He has the picture taken first with the collargol in the bladder, then empties the viscus, distends it with air, and has another picture taken. He states that in this way the neoplasms are brought into strong relief. He also considers the method of value in revealing large diverticula which cannot be satisfactorily seen through the cystoscope. In a recent review of x-ray work in diseases of the bladder and prostate, E. H. Skinner[2] cites several cases in which valuable diagnostic information has been obtained. Bismuth emulsion has been used as well as collargol.

DISEASES OF THE PROSTATE.

Prostatectomy. Some years ago in this review attention was called to Colmer's method of doing perineal prostatectomy under local anesthesia, and last year reference was made to Legueu's method of using it for the suprapubic operation.

At last year's meeting of the Southern Surgical and Gynecological Association, Carroll W. Allen,[3] of New Orleans, contributed an interesting article on this subject. He practises the suprapubic operation, injecting the operative field before the skin incision is made, infiltrating along the median line for a distance of three or four inches, and then carrying the

[1] Münch. med. Wochenschrift, 1914, No. 35.

[2] Interstate Medical Journal, June 15, 1915.

[3] Surgery, Gynecology and Obstetrics; Transactions of Southern Surgical and Gynecological Association, 1915.

needle down through the sheath of the rectus muscle at short intervals. Before the bladder is incised, its superior wall is also infiltrated. After the bladder has been opened, the patient is placed in the Trendelenburg position, thereby giving the operator a better view of its interior, and about a half-dram of the solution is injected in four or five places around its outlet.

The author states that he has found a preliminary intravesical injection of any analgesic fluid to be unsatisfactory, and consequently has abandoned its use for the infiltration method. After the vesical neck has been infiltrated in this manner, the needle is passed into the internal meatus, and the deep urethra injected on each side. The finger is kept in the rectum so as to facilitate the passage of the needle around the prostate. In cases in which there is decided elevation above the internal meatus, an injection is made there also. The solution used is one-half per cent. novocain with 10 minims of adrenalin chloride solution to the ounce. Enucleation of the gland is stated to be painless and accompanied by very little hemorrhage. A catheter is passed in through the urethra before enucleation is begun, and, after the gland has been removed, a piece of silk is tied around its proximal end and drawn out through the urethra, after which a cone-shaped pad of gauze is attached to the proximal end of the thread and placed in the cavity made by removal of the gland. Traction upon the distal end of this thread draws the tampon well down against the walls of the cavity and guards effectually against hemorrhage. The distal end of the tampon is brought out through the suprapubic opening in order to make its removal easier. This method of packing, which originated with Dr. Rudolph Matas, has been found by the author to be very useful. In many cases the two-stage operation has been done, but in those patients whose condition warranted it the operation has been completed at one time.

In his paper Dr. Allen also discusses the preliminary treatment for prostatectomy, calling attention to the liability to anuria in patients whose kidneys have been damaged owing to back pressure resulting from enlargement of the prostate and to the danger of suddenly emptying an overdistended bladder. In a recent communication, I[1] expressed my views on the matter of preparatory treatment and indicated those measures which I have found most serviceable in getting patients ready for operation. In the first place, when dealing with a case of prostatic hypertrophy, it is necessary to bear in mind that we have to do not only with a mechanically obstructed bladder, but also with other organs, tissues and systems which in the aggregate constitute the bodily economy, and which have been affected singly or collectively, in part, or in their entirety, by retrograde changes incident to time or by the destructive products of disease, and that it is quite as important to give attention

[1] Interstate Medical Journal, September, 1915.

to these general conditions as it is to the local one. The kidneys, heart and bloodvessels, the respiratory system and gastro-intestinal tract, and last, though by no means of lesser importance, the nervous system, require most careful investigation, and everything possible should be done to correct each and every impairment of function that can be detected. Further experience during the last year has served to confirm the views expressed in the last review concerning the value of the functional renal tests in this class of cases.

For increasing renal function, such drugs as spartein sulphate, theocine-sodium-acetate, diuretin and potassium acetate with infusion of digitalis will prove useful if judiciously given according to the indications in the individual case. Perhaps a word of warning against the routine use of digitalis, however, may not come amiss. It should not be given to patients having myocarditis and a high blood-pressure, for under such conditions it does more harm than good. It has been my misfortune to see patients in consultation whose condition has unquestionably been made worse by the administration of this drug. When the blood-pressure is high, the nitrites seem to be of temporary advantage, not only reducing the pressure, but also increasing diuresis.

In some cases the old-fashioned Niemeyer pill, given a few days at a time at intervals, will not only markedly increase the action of the kidneys, but will also clear up the associated symptoms of gastro-intestinal disturbance, causing the dry, glazed and brown-coated tongue to become moist and clean, and making the skin assume a clearer hue and softer texture.

As a rule no direct treatment need be employed for mild nervous symptoms; they diminish or disappear with the establishment of better elimination. Persistent nervous disturbances, however, betoken post-operative trouble.

As to urinary antiseptics, urotropin is the only one I have found of any value, and that should be given in large doses. My experience in the use of autogenous vaccines for the purpose of reducing vesical infection has been so disappointing that I have not resorted to them of late. These systemic measures, together with proper hygiene and adequate local treatment, do much for prostatics, reducing their residual urine, relieving toxemia, diminishing renal infection, and bringing about such general improvement that after a few weeks the patients can usually be brought to operation with far greater safety than they could were surgery resorted to earlier.

Under the title of "Factors Which Determine the Advisability of Prostatectomy," William F. Braasch,[1] of the Mayo Clinic, also makes a contribution to this subject. He calls attention to the difference of opinion entertained by European and American surgeons with refer-

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[1] Collected Papers of the Mayo Clinic, 1914, vi.

ence to the advisability of operating in all cases, and points out that those in this country have generally held that operation is indicated as soon as it is plain that patients have persistent residual urine. Renal insufficiency, infection, lithiasis, atony of the bladder and carcinoma he considers as factors which may render operation inexpedient.

In discussing renal functional tests, he states that experience in the Clinic has engendered the belief that the patient's general condition after the bladder has been drained affords the best index for determining the advisability of operation; that is, if the patient feels better, has become stronger, has a good appetite and has put on flesh, then it is safe to assume that he will go through an operation even though the functional renal tests are not up to the standard. He believes that in cases in which there is considerable residual urine present, more good can be derived from suprapubic drainage than from the catheter. When the residual urine is purulent it has generally been found that the case is complicated by pyelonephritis, a condition which puts a very serious aspect upon the case. Continued drainage is recommended in the hope that the patient's resistance to the infection may be so increased that eventually he may be brought to operation. Commenting upon this complication, however, the author states that it has been found that operation will sometimes so lower the patient's vitality, even when renal function has apparently been restored to the normal, that he will succumb within a few days. Unfortunately, this has been the experience of others who have not had such a large number of cases as the Mayos have been privileged to treat.

Urinary antiseptics and vaccines, it is stated, have not been found of much value at the Clinic. As mentioned above, I have abandoned the use of vaccines entirely because they proved disappointing. Full doses of urotropin, however, seem to do good in some cases.

In 14 per cent. of the cases, stone in the bladder was found. The practice of removing the stone from the bladder and doing the prostatectomy later after drainage has been secured is certainly a commendable one in cases in which the urine is purulent or in which there has been much retention. In simpler cases it is stated that both stone and prostate have occasionally been removed at a single operation.

With reference to true atony of the bladder dependent upon hypertrophy of the prostate, it has been found that the bladder gradually regains its tone so that in course of time it comes to empty itself.

It is very interesting to note that Dr. Braasch discountenances the use of the cystoscope as a routine procedure in hypertrophy of the prostate, for he believes there are cases in which it will do great damage, even to the extent of causing death. This is the stand which I have always taken in spite of the increasing tendency to use the instrument. There are certainly many cases in which nothing whatever can be learned by it, and in which its passage causes the patient great pain

and not infrequently unpleasant, and even dangerous, after-effects. Dr. Braasch's rules for the use of the cystoscope are as follows: When urinary obstruction is evident, without any apparent cause, on rectal examination; when there is evidence of possible vesical or renal complication; and when the condition of the prostate is doubtful upon digital examination.

Chronic infection in hypertrophied prostate has been found to simulate advanced malignant disease, and thus lead to a decision against operation until localized softening revealed the true nature of the trouble.

For controlling hemorrhage after suprapubic prostatectomy, Hagner,[1] of Washington, uses a rubber bag, which he passes into the cavity made by enucleation of the gland and then inflates it. A specially constructed sound with bevelled end is passed into the urethra and out through the suprapubic wound. A rubber tube attached to the open end of the bag is threaded over the bevelled end and the sound withdrawn through the urethra, the tubing being pulled through and the bag being pulled into place by traction on the tube. After the bag is inflated, the air is retained in it by clamping or tying the tube which remains outside the urethra. In the ten cases in which this appliance was used, there was no formation of blood clots in the bladder, and, in those in which continuous irrigation was employed, the fluid came away clear. The author states that after the bag is put in place, bladder irrigation will show a good deal of hemorrhage; but as soon as the bag is inflated and properly adjusted in the cavity left by the removal of the prostate, the bleeding stops at once. At the end of twenty-four hours the air is let out of the tube and at the end of forty-eight hours the bag is removed. The author has also had a bag constructed having an inlet and outlet so that it may be filled with hot or cold water, but he has found the one intended for air distention to be more simple and equally satisfactory.

Bransford Lewis[2] makes an interesting contribution to the study of obscure forms of prostatic obstruction and vesical atony, which he believes to be always due to one of two causes, either a mechanical obstruction or interference with the nervous mechanism which controls urination. Criticizing the various theories which have been advanced in explanation of these obscure cases, he refers to Thomson Walker's series published some years ago, and states that the measures employed by Walker do not seem to him to be sufficient to permit the exclusion of mechanical obstruction at the neck of the bladder, particularly contracture of the internal meatus. He cites a case in proof of his theory that the condition is not subject to detection by the usual methods

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[1] Transactions of the American Association of Genito-urinary Surgeons, 1914; also Surgery, Gynecology and Obstetrics, November, 1914.

[2] Annals of Surgery, March, 1915.

of examination, including cystoscopy and even the passage of full-sized instruments into the bladder. It was that of a patient, thirty-nine years of age, who had always had to strain in starting the urinary stream, and also had experienced difficulty in expelling the urine from the bladder. His condition had progressed to such a degree that he had been obliged to use a catheter regularly for a number of weeks prior to the time he consulted Dr. Lewis. At that time he had 24 ounces of residual urine. His obstruction was found to be at the vesical neck, and was considered to be due to prostatic contracture, although no changes could be detected by the cystoscope. He improved so much under the use of a posterior dilator that the residual urine was reduced to 3 ounces and was maintained at that quantity by repeated deep dilatation up to 37° or 39° F. Because of the difficulty experienced in keeping the patient even in this relatively satisfactory condition, it was decided to adopt more radical measures of treatment and, accordingly, perineal section was performed and the neck of the bladder explored. When the finger was introduced into the viscus, a ring of fibrous tissue was felt at the vesical neck. Multiple incisions were made in the ring and a drainage tube introduced. This operation, however, was not sufficient to secure marked relief from the obstruction, so a similar one was done at the end of a week, after which there was free passage of the urine. Another case similar to this one yielded to dilatation of the deep urethra. At the first examination pain was experienced and resistance encountered when the dilator reached 23° F. Eventually dilatation was carried up to 40°.

Dr. Lewis believes contracture similar to that which obtained in these two cases is often overlooked, and that in some cases it may be extremely difficult, or even impossible, of detection, except by palpation through a perineal or suprapubic incision.

With regard to treatment, he recommends the use of the deep Kohlmann dilator, at short intervals, the dilatation being gradually increased, and careful watch being kept upon the effect which the treatment has upon micturition and also upon any change that may occur in the quantity of residual urine. He thinks that the modern posterior examining urethroscopes may be helpful in making a diagnosis in some of these cases.

Not the least interesting part of Dr. Lewis's paper is that devoted to the etiological effect of spinal syphilis in the production of retention and atony. He has had a number of cases in middle-aged or old men in whom there was no history of luetic infection, but in whom a searching examination gave rise to the suspicion of incipient spinal syphilis, a suspicion which was confirmed by the Wassermann test, applied either to the blood or to the spinal fluid, or to both. In these patients no local cause whatever could be detected to account for the vesical symptoms and they seemed to be devoid of those characteristics which the neurotic

type of patient manifests. Neither the patients nor their physicians had thought of syphilis as an etiological factor in their urinary disturbance. The importance of making a correct diagnosis in these cases is so plain as to need no comment. In addition to specific treatment, Dr. Lewis has found that high dilatation of the vesical neck increases the power of micturition and also reduces the quantity of residual urine. He uses vesical irrigations in connection with these measures. It occurs to me that it would be interesting to try the effect of glycerin injections in such cases.

Another interesting case similar to this has been reported by J. Dubs,[1] of Zurich. It was that of a man, aged sixty-nine years, who, prior to the beginning of his present difficulty, had always been perfectly well and had never suffered from any venereal affection. About four weeks before he came under observation he suddenly experienced difficulty in voiding his urine, and this difficulty had increased until a condition of almost complete retention had been reached. The passage of a catheter encountered no obstruction such as occurs in hypertrophy of the prostate. Rectal examination revealed the presence of a prostate much smaller than normal and it was impossible to distinguish the two separate lobes. The bladder was opened suprapubically and found to be considerably thickened and presenting some trabeculæ. The internal meatus was very much contracted and the prostate was found to be much smaller than the normal organ. No valve-like folds could be detected at the internal meatus. The base of the bladder sloped gradually downward from the atrophied prostate until it reached the vesical neck. When the finger was introduced into the internal meatus, a hard, non-dilatable, narrow ring was felt. An incision was carried around it and enucleation of the prostate begun. After much difficulty a small, hard piece of tissue, not much bigger than a bean, was removed from the site of the left lobe, but from the right side nothing could be shelled out. The tissue in this region felt very thick, hard, and resistant. Pathological diagnosis was senile involution-atrophy of the prostate with fibrous contraction. Shortly after the operation the patient was absolutely free from any difficulty, a result attributed to removal of the resilient indurated tissue at the vesical neck. The author states that the successful result obtained in this case would lead him to treat other cases of atrophy of the prostate in the same way.

Benjamin Tenney,[2] of Boston, and H. A. Fowler have also recently discussed obscure forms of prostatic obstruction, Tenney having analyzed 64 cases which he collected from various sources. He advises suprapubic exploration in these cases, believing that it places the surgeon in better control of the situation than perineal exploratory operation.

[1] Beiträge zur Klinische Chirurgie, 1914, Bd. xc, Heft 2.
[2] Surgery, Gynecology and Obstetrics, August, 1915.

In one case Fowler obtained a good result by removing a wedge-shaped piece of tissue from the floor of the vesical outlet, using the cautery somewhat after the method of Chetwood.

In discussing the preoperative treatment of prostatectomy, B. A. Thomas[1] calls attention to an interesting and, as he believes, valuable modification of the indigocarmin functional test. When the functional capacity of the kidney is diminished, Thomas believes that not only will the onset of the elimination be delayed, but that the amount of early elimination will also be diminished and the time for complete excretion of the dye will be prolonged. So it seemed to him that the relative output for the first and third hours would give a better idea of the functionating power of the kidney than would the quantitative elimination for the first and second hours. By dividing the output of the first hour by the output of the third hour, he obtains a proportion which he calls the **index of elimination** and which he has shown to be 5.1 in the case of normally functioning kidneys. If the amount excreted during the third hour equals or exceeds that excreted during the first hour, he considers operation contra-indicated, except when the total elimination for three hours exceeds 20 per cent. Under the latter circumstances he states *that operation may be considered, even though the index of elimination* be very low. In the discussion which followed Thomas's paper, the question was asked whether the same method would apply to phenolsulphonephthalein, to which Thomas replied that he had not used it with that substance, but believed that the test would hold good.

A. Hyman,[2] of New York, has made some interesting x-ray studies of the bladder after suprapubic prostatectomy. He found that the base was wider, just as it is in prostatics who have not been operated upon, and that occasionally it would seem to extend further upward than in the latter class of patients. Frequently it was more pear-shaped, which he considers as possibly due to adhesions to the anterior abdominal wall. The most important and interesting change which he observed was at the vesical outlet. In only a few cases could he detect any narrow tunnel-shaped extension in the region of the vesical neck. In very few cases did the picture show absence of changes in these regions. So the author concludes that the internal sphincter escapes injury in only a very small percentage of operations. In the greater number of cases the picture revealed two distinct cavities, a large one above, corresponding to the bladder itself, and a smaller one communicating with the other and extending to the region of the compressor of the urethra, corresponding to the site previously occupied by the enlarged prostate. The shape of the second cavity was variable, in some cases

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[1] Journal of the American Medical Association, November 28, 1914.
[2] Zeitschrfit f. Urologie, Bd. viii, Heft 9.

being round, in others oval, and in still others tunnel-shaped, the last-named being most common. The presence of this small hollow the author explains by assuming that the internal sphincter had either been destroyed during the operation, or that its function had been so impaired that it was unable to close the bladder. Its place he believes to be taken by the compressor urethræ muscle. This belief was confirmed by posterior urethroscopic examination, also by the fact that the catheter passed directly into the bladder when it got beyond this muscle, and that the urine flowed through it without the patient making any voluntary effort. The author concludes that the compressor urethræ assumes the function of the internal sphincter in the great majority of patients who have been subjected to suprapubic prostatectomy.

Cancer of the Prostate. At the last meeting of the International Congress of Urology, one of the topics of discussion was cancer of the prostate, the reporters being Wilms, Verhoogen and de Martigny.[1] Wilms expressed the opinion that the frequency with which hypertrophy is followed by malignant change, occurring as it does in about 20 per cent. of all cases, constitutes an imperative reason for operating upon all patients having hypertrophy in their early stage. With reference to radical operation, once carcinoma has been diagnosticated, he favors the method of Young, although he considers it contra-indicated when metastases have occurred in the bones or in other parts of the body. Under such circumstances the most that can be done is to relieve the retention of urine and keep the patient as free from pain as possible. In the case of patients whose condition is such that it is doubtful whether they can withstand this extensive operation, he believes the question of partial removal should always be considered. Naturally, the cases which can be diagnosticated in their incipiency, when the trouble is confined to the prostate itself, are suitable for simple prostatectomy, which offers good chances of permanent cure. The resistance of many patients becomes so reduced that they are at best poor subjects for surgery, especially if they are advanced in years, as is so often the case. Verhoogen lays it down as a general rule that those who have passed their sixty-fifth year should not be subjected to extensive dissecting operations for radical cure, although he makes an exception in the case of individuals who show exceptional vigor. He places great reliance upon the functional renal test, and states that if one examines a record of the autopsies upon patients who died after prostatectomy, the most common cause of death will be found to be renal insufficiency. This seems to be quite in accord with certain clinical manifestations which fortunately are better recognized now than they were some years ago; certainly there is no surgeon of any judgment and experience who would do prostatectomy upon an old man at the present time without

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[1] Journal d'Urologie, August 15, 1914; Folia Urologica, March, 1915.

previously investigating the condition of his kidneys. The greater number of patients whom Verhoogen has seen came under his observation at a time when the limits of malignancy had extended considerably beyond the prostate. He considers radical operation indicated, however, so long as the tumor has not become fixed to the lateral pelvic walls, and has not extended so far upward that the finger cannot reach its highest limit through the rectum. All of the reporters discussed the treatment by means of physical agents, especially radium.

Dr. de Martigny also mentioned the effect of the *x-rays* and, basing his opinion upon their well-known action upon normal tissues, thought that they might have some beneficial action in cancerous growths of the prostate. With reference to *radium*, it was generally agreed that insufficient doses of any radio-active substance will rather stimulate carcinoma to greater growth than render it less active, and this is an opinion in which I freely concur, although I have not had the opportunity of seeing it used in carcinoma of the prostate. It has been my misfortune to see a number of cases of carcinoma of the jaw in which I felt sure that radium treatment had made the patients worse instead of better and shortened, instead of lengthened, their lives.

Verhoogen believes that this treatment possesses a certain value. He states that it is far too early to say anything about cure for the double reason that the treatment is too new, and that carcinoma is such a serious disease that there is no place for enthusiasm about new methods of treatment which are put forward as being able to produce permanently curative results.

With reference to the way in which radium is used in cancer of the prostate, it may be stated that it can be applied upon metallic sounds of different shape which are covered with a varnish containing radio-active substances so prepared that each square centimeter of the surface shall contain a centigram of the radium salt. It may also be introduced upon a metallic sound containing a salt of radium or by means of a rubber catheter in which a little glass tube of radium has been placed. It can also be brought into contact with the prostate through the rectum, but de Martigny believes that it is better to put it into the bladder and thus apply it more directly to the new growth. He states that the result is in direct relation to the quantity of radium employed, 100 to 150 milligrams being considered a sufficient quantity to bring about a rapid retrogression of the tumor. The treatment may be repeated during a week or ten days, and it seems that the exposure can be continued from twenty minutes to an hour according to the quantity of radium employed. De Martigny's results with this method of treatment have been extremely gratifying, and he believes that radium treatment will be the treatment of choice in the future, either in combination with surgery in the early cases or as the sole treatment in those which are inoperable.

At the last meeting of the Southern Surgical and Gynecological Association, E. S. Judd,[1] of the Mayo Clinic, read a paper based upon 93 cases of cancer of the prostate which had been operated upon up to December 1, 1914. His statistics also show that in 20 per cent. of cases of enlargement of the prostate, cancer is present. Judd calls attention to the unwillingness with which surgeons have adopted radical operation for this condition, a circumstance which he attributes largely to the difficulty of completely removing the diseased gland, together with the adjoining part of the bladder, without destroying the patient's control of micturition. He states that patients should be informed that such operations will deprive them of control of their bladder. When catheterization is attended by great pain and hemorrhage, he recommends a palliative operation, and states that he has found that the removal of the obstruction to the vesical outlet, together with a portion of the carcinoma, will produce temporary relief, and therefore advises it when the condition of the patient is such as to warrant intervention. For those who are incurable because of the extent to which their disease has progressed, but who are fairly comfortable, he warns us against operation until the patient's condition becomes such as to make it necessary to afford him some relief, when a palliative operation can be done.

It is possible to trace 82 of the 93 patients operated upon, a simple prostatectomy, either suprapubic or perineal, having been done in every case.

Of this number, 8 lived more than three years; 12 lived more than two years; 13 lived more than one year; 24 died within the first six months; 5 died, time unknown.

Patients still living after six months, 3; after one year, 7; after two years, 4; after three years, 3; after four years, 2; after nine years, 1.

The patient who is living and well after nine years had a very small cancerous nodule removed.

DISEASES OF THE PENIS AND URETHRA.

Zinc Ionization in the Treatment of Cancer of the Penis. G. Betton Massey,[2] of Philadelphia, reports 2 cases of epithelioma of the penis treated by zinc ionization. One was an early, and the other a late case in which one of the lymph nodes in the groin was distinctly palpable. The first case was that of a man, aged fifty years, who, nine months previous to the time he came under Dr. Massey's observation, first noticed a swelling near the frenum which he thought might have been caused by a mosquito bite. It failed to disappear, how-

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[1] Collected Papers of the Mayo Clinic, 1914, vi.
[2] American Journal of Surgery, August, 1915.

ever, and during the preceding six months had increased rapidly in size, so that it now measured 2 by 1½ cm. Under the local injection of 2 per cent. solution of quinin and urea hydrochlorid, bipolar ionization with the zinc ion was applied until the new growth had been completely destroyed. "Six fine zinc needles were inserted immediately underneath the tumor, pointing concentrically, connected with the positive pole of the direct current, with the small negative electrode pressed against the centre of the growth, and with all electrodes immovably in place a current of 50 milliampères was gradually turned on and maintained for 52 minutes." The wound healed very promptly and seven months later the patient was free from any sign of recurrence. The other case was that of a man, aged sixty-six years. Two and a half years before he came under Dr. Massey's observation, a white spot appeared upon the glans penis and increased steadily in size until the entire glans became involved. He was treated by bipolar ionization applied in the same way as in the other case, except that larger electrodes were used and a current of from 300 to 700 milliampères was employed. The lymph node in the groin was destroyed by the same method. The slough came away without any hemorrhage. Six months afterward the patient was free from recurrence. I am not familiar with this method of treating carcinoma of the penis, and hence cannot make any comment upon it. It would be interesting to follow the patients and see what the ultimate result would be.

Hypospadias. A variety of operations have been employed for reconstruction of the urethra in perineoscrotal hypospadias, all of which, however, may be placed under two general classes; namely, urethroplasty by tunnellization, and urethroplasty by formation of mucocutaneous flaps. In a recent paper treating of this subject, Pousson[1] states that he has made use of the flap method for forty years, although he has occasionally tried the other method which, however, has not given him such good results as the former procedure. After an operation done according to the technic of Nove-Josserand, one patient was so unfortunate as to have gangrene take place in the newly constructed canal. The author has now abandoned all tunnellization methods and returned to the exclusive practise of Duplay's operation, which he has modified slightly in some respects. He agrees with Marion that the best guarantee of success is given by doing the operation in several stages, and he insists upon the advisability of making the patients or their parents understand that a perfect result can be obtained only after a considerable time, that is, from six months to a year. A condition which especially prolongs the treatment of hypospadias is the necessity of straightening the penis by division of the fibrous band which causes its recurvation, for it is only after complete healing has taken place that

[1] Zeitschrift f. Urologie, Bd. viii, No. 6.

the reconstruction of the urethra can be attempted. Thus it becomes necessary to wait several months before undertaking the latter procedure. The author expresses the opinion that sufficient attention has not been paid to the importance of correcting the recurvation of the penis, which he has always found to be of considerable degree even in patients having balanic hypospadias. For correcting this deformity he practises the following operation: After the blood supply of the organ has been cut off by encircling it at the root with a soft-rubber catheter, the base of the glans is separated from the corpora cavernosa by an incision carried down through the coronary sulcus. A second incision is then begun 1 cm. behind the first one, and is carried obliquely downward and forward until it reaches the termination of the first one, the two together thus excising a wedge-shaped piece of tissue. The wound is then brought together by deep sutures. Very little bleeding occurs during the operation, and the suture, if properly placed, will safeguard against hemorrhage when the constricting catheter is removed from the base of the penis. Care should be taken, however, to suture the wound deeply. The anterior constricting band is also divided during this stage of the operation. The author states that for a few days after this operation the glans loses its sensibility but soon recovers it again. There was only one case in his series in which its rigidity was not maintained during erection. His method of forming the urethra is practically that used by Duplay in his first operation, consisting in giving the new channel a cutaneous erectile covering by employing a portion of the corpus spongiosum. Beginning 8 mm. from the median line he makes a longitudinal incision on one side of the urethral furrow, beginning at the glans and terminating opposite the abnormal orifice. A transverse incision 6 mm. long is carried outward from each extremity of this cut. A flap is then dissected from within outward, comprising the entire thickness of the coverings of the penis. This step of the operation does not differ from Duplay's except that the longitudinal incisions are made more externally, a modification which permits a small strip of skin about 4 or 5 mm. in width to be utilized in constructing the inner tunic of the urethra. The next step consists in making two small transverse incisions and dissecting up the internal flap. The same procedure is carried out on the other side, except that the longitudinal incision is made a little nearer the median line, so that the internal flap is somewhat smaller than its fellow on the opposite side. This inequality of the internal flaps serves to draw their line of suture slightly away from the line formed when the two external flaps are brought together, and thus destroys the parallelism between the two. The urine is kept out of the newly formed channel either by passing a sound through the hypospadic opening or by draining the urine through a perineal incision.

End-results in Epispadias. Duenkeloh[1] makes a report upon the end-results obtained by Thiersch in 5 cases of epispadias which that surgeon operated upon according to his own method. In 3 cases the plastic result was excellent, the urine being passed entirely through the new urethra. In the fourth case a small fistula persisted near the root of the penis. The fifth case was a failure, in that incrustation of such a degree was present as to make it necessary to abandon the operation. It was possible to form only the upper two-thirds of the roof of the bladder. Recent examination of the patients, of whom four are now living after the lapse of years, shows that they are obliged to wear a urinal, but that they are satisfied with their condition, being able to do hard work and suffering very little from stone formation. They are normal sexually, although intromission of the penis is impossible on account of the small size of the organ. One patient was operated upon in January, 1913, for a renal calculus. The other three so far as known have normal kidneys. All, however, suffered from a moderate cystitis. The fifth patient died in 1913 of a carcinoma of the bladder; this was forty years after the operation.

DISEASES OF THE TESTICLES, CORD, AND SEMINAL VESICLES.

The Operative Treatment of Epididymitis. This form of treatment seems to be gaining in favor with the profession. During the year several contributions to it have been made. My own experience with the procedure during the time that has elapsed since the writing of the last review has served to confirm the high opinion which I expressed at that time. In every case in which it has been used there has been an immediate cessation of pain, and the duration of the attack has been considerably shortened.

A very interesting contribution to the subject has been made by Crosbie and Riley,[2] who have resorted to operative treatment in their practice at the Boston Dispensary. Being impressed with the unsatisfactory results obtained by the palliative treatment, they began to do epididymotomy in very severe cases which occurred in their service, and the results proved so satisfactory that they soon began to use it in milder cases. The total number of patients treated up to the time of publication of their paper was 28, in 2 of whom the complication was bilateral. Although at first they used general anesthesia, they now operate a great deal under local, using 20 to 30 c.c. of a 1 per cent. solution of novocain, to which from 3 to 6 drops of adrenalin chloride solution are added. At first they infiltrate the cord. The needle is inserted at the external abdominal ring and 5 or 10 c.c. of the solution

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[1] Centralblatt f. Chirurgie, December, 1914.
[2] Boston Medical and Surgical Journal, May 6, 1915.

are injected, being forced in all directions by manipulating the needle, special care being taken to force some up into the inguinal canal and to deposit some around the globus major. The scrotum is then infiltrated on the affected side, and finally a little is injected along the line of incision. It has been found that the testicle and epididymis can be handled without pain after the solution has had time to take effect; and also that there is no sensation in the parts for two or three hours afterward. The wound is closed with a through-and-through silkworm-gut suture extending from the tunica vaginalis to the skin, the authors believing that this method is superior to layer suturing in that it allows drainage. The patients are permitted to go home after the operation, but are advised to remain in bed for two days if they possibly can.

The author's conclusions are as follows:

1. There is immediate and permanent relief of pain.

2. There are no recurrences unless fresh infection takes place.

3. The course of the urethritis is shortened.

4. There is less liability to sterility.

5. The treatment of the urethritis can be resumed earlier than after other methods.

6. The operation may be safely done in an out-patient service.

The last conclusion, if further experience prove it to be correct, will certainly constitute an advance in the treatment of this serious complication of gonorrhea. I have not performed the operation outside of the hospital and have always kept my patients in bed for a few days. If the method can be extended to ambulatory patients, it will certainly be a great convenience for many of them.

Oliver Lyons,[1] of Denver, also reports favorably upon the method and states that he has employed it eight times under local anesthesia. He agrees with the authors just mentioned that local treatment of the urethritis can be begun earlier after this method than after others, and states that he not only resorts to deep urethral injections at the expiration of ten days, but also begins to massage the prostate at that time. I should hesitate a little to employ the latter measure at so early a date, at least until further experience shall have demonstrated its harmlessness. It has been my misfortune to produce epididymitis a few times by massaging the prostate too early. It is interesting to note that Dr. Lyons has not found any macroscopic pus in the epididymis before the third day, but invariably found it after the fifth day. The gonococcus and the colon bacillus were usually the only bacteria that were found.

Gonorrheal Spermatocystitis. In an interesting contribution to this subject, Luys[2] summarizes the distinctive signs of chronic spermato-

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[1] Denver Medical Times, February 15, 1915.
[2] Le Monde Medical, June–July, 1915.

cystitis as induration of the vesicular walls, sensitiveness of the vesicle to touch, pain in the verumontanum, and the presence of particles of vesicular casts and plugs in the secretion obtained by massaging the vesicles. The total quantity of urine is also usually turbid. The degree of induration of the vesicles varies greatly, in some there being only a few nodules detectable, while in others the whole vesicle may be involved. Between these two extremes are variations of all degree. The author has found that the verumontanum is involved in this affection, and he believes that this condition is due to the fact that it is bathed constantly by the diseased products discharged upon it from the vesicle. He compares the vesicle to a bottle turned upside down with the body above and the neck below, the latter terminating just at the site of the verumontanum, so that its contents are bound to pass over the latter structure whenever they are discharged. In fact he goes so far as to state that disease of the verumontanum is almost always dependent upon a spermatocystitis. Not only does the urethroscope show changes in this structure, but sharp pain can be produced upon rectal examination when the examining finger reaches the lower part of the groove between the two lobes of the prostate, which corresponds exactly, according to the author, to the position of the verumontanum. Among subjective symptoms which the author noted is diurnal frequency of urination, accompanied by pain in the perineum and pain in the glans penis. In some cases, too, patients have complained of pain when they are sitting down. Disturbances of the sexual function, such as pain, or even spermatic colic at the moment of ejaculation sometimes appear. There may also be interference with potency, which has a bad psychic effect upon the patient. Recurrent epididymitis is also a common complication. In discussing treatment, he states that such operations as vasotomy, vesiculotomy and vesiculectomy are not usually necessary, inasmuch as his patients have gotten well as the result of massage to the vesicles and local applications to the verumontanum. He attributes many failures by massage treatment to the fact that the vesicles are not thoroughly emptied. In order to get good results, the entire organ must be emptied from its fundus downward, and the treatment must be repeated frequently and continued for a long time. The verumontanum he treats directly through the urethroscope, but before resorting to this method he dilates the posterior urethra by curved sounds or dilators, and uses very copious irrigations. This treatment reduces the irritability of the posterior urethra so that the urethroscope can be used. In some cases, too, he considers it necessary to give direct treatment to the ejaculatory ducts, which are often contracted and require dilatation. He believes that when such conditions exist, a cure cannot be brought about until the patency of the ducts has been reëstablished, so that free emptying of the vesicles can be accomplished. When the ducts are strictured, he has found that mas-

sage will not only prove useless, but may even give rise to irritation. With reference to the operations of vasotomy and vesiculotomy, it seems to me that both these procedures have been sufficiently well established by Belfield and Fuller, respectively, to have attained a definite place among the methods of treatment of this oftentimes rebellious affection. Naturally, they will be reserved for cases which do not yield to the simpler measures, and a good deal will depend upon the judgment and experience of the surgeon in resorting to them.

Further X-ray Studies of the Seminal Vesicles. In last year's review mention was made of Belfield's interesting radiographic studies of the seminal vesicles. During the year another contribution to this subject has been made by Thomas and Pancoast, of Philadelphia, who have not only studied the structural changes in the vesicles and ducts, but have also treated some cases of vesiculitis by injecting medicinal substances through the vas. Thomas believes that collargol itself possesses a definite therapeutic power, as some patients in whom it was used for the purpose of obtaining a radiograph improved very much, both subjectively and objectively, as evidenced by the disappearance of urethral, perineal and vesical pain and reduction of the pus content in the semen. The method permits the detection of inflammatory enlargements of the vesicles, especially loculated collections of pus, the presence of obstruction in the vas and congenital anomalies.

In discussing the treatment of chronic vesiculitis, the authors expressed the opinion that massage, correctly performed, will bring about cure in the majority of patients. There will be a certain percentage, however, in whom vasopuncture, together with the injection of medicinal substances, vasotomy, and even vesiculotomy may be required. The two last-named procedures, however, he believes should be reserved for patients in whom all other methods have failed.

MISCELLANEOUS.

Anesthesia in Urology. At the last meeting of the International Urological Society the question of anesthesia in urology was thoroughly discussed. Bier,[1] of Berlin, who read the first paper, endeavored to define the application of local anesthesia to operations upon various parts of the genito-urinary tract. He expressed the opinion that nearly all urological operations can be done under local anesthesia, and, with the exception of certain operations upon the kidney, such as freeing it from its bed and ligating its pedicle, he has found that they can be carried out painlessly. With reference to the last-named procedures, it has been his experience, that if primary ether anesthesia (aetherrausch) be induced just at the time they are done, the whole

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[1] Folia Urologica, March, 1915.

operation will be quite devoid of pain. In discussing the two methods of local anesthesia for renal operations, namely, the infiltration method and the conductive method along the dorsal and lumbar nerves, he states that both have given very good results in his hands, rendering the performance of such relatively minor procedures as pyelotomy and the suture of a movable kidney into position quite painless. The infiltration method, however, has proved more acceptable for delivering the kidney and for ligating its pedicle. This method is also more simple and, as it gives equally as good results in the majority of cases as the conductive anesthesia, he considers it usually preferable. Conductive anesthesia, however, is more satisfactory for the removal of very large or firmly adherent kidneys.

For rendering operations upon the bladder, prostate and urethra painless, he considers Braun's parasacral conductive method superior to any form of local anesthesia. In his experience it is not only more satisfactory than either of the other methods, but is also more simple technically, and furthermore possesses the advantage of being equally applicable to operations upon any of these organs. When it is employed for suprapubic vesical operations, it must be supplemented by an infiltration of the abdominal wall and the prevesical space with 0.5 per cent. novocain solution, inasmuch as these regions are not brought under the influence of the anesthesia introduced along the parasacral route. For the removal of vesical calculi, he has found simple infiltration of the tissues in front of the bladder, together with the vesical mucous membrane itself, to be entirely satisfactory and, furthermore, he has proved that suprapubic prostatectomy can be done with a considerable degree of satisfaction if the tissues around the prostate be infiltrated with the same solution after the bladder has been opened. He thinks, however, that parasacral anesthesia affords greater assurance of a painless and satisfactory operation than does the infiltration method. For anesthetizing the mucous membrane of the urethra and bladder, he prefers a 3 per cent. solution of alypin with the addition of 1 drop of suprarenin to each cubic centimeter. It may be remembered that in this review for last year mention was made of certain cases of poisoning which had followed the use of alypin for this purpose, and, in the discussion which followed the symposium, Necker, of Vienna, stated that he had seen toxic effects follow its employment in a number of cases. For scrotal operations, Bier believes that local anesthesia long since established its claim as the method of choice.

Spinal analgesia he thinks has dropped into well-merited disuse as the field of local anesthesia has become better developed. He believes, however, that it should not be abandoned altogether, but that attempts should be made to render it more safe, inasmuch as it gives really more satisfactory control of the patient than any other form of anesthesia, excepting that induced by general anesthetic drugs. It is interesting

to note that Bier, who has long favored local anesthesia in a variety of operations, calls attention to the very great improvement which has been made in the administration of general anesthetics, with the result that their dangers have been greatly reduced. He furtheremore states that in cases in which there is not a direct contra-indication to general anesthesia it may be a matter of choice with the surgeon whether he will use a general or local anesthetic. He considers that ether given by the drop method, preceded by a hypodermic injection of morphin and atropin, constitutes the best method of general anesthesia. In this opinion I heartily concur. I have used it for ten years without a single accident.

Pasteau and Michon continuing the symposium, place special stress upon the importance of determining the functional capacity, not only of the kidneys but of the liver as well in all patients in whom there is any doubt about the advisability of giving a general anesthetic. It has been proved beyond doubt, they explain, that both chloroform and ether, although in different degree, exert an injurious effect upon the liver and kidneys. While theoretically this action might lead one to renounce their use, it has been found in practice that the injury which they inflict, though often sufficient to give rise to clinical manifestations, is usually transitory; so it follows that if they be properly administered, if not too much be given, and if the operation be not unduly prolonged, either of these drugs, particularly ether, can be given the patients whose condition is such that they do not constitute the best surgical subjects. In discussing spinal anesthesia, these French surgeons state that it possesses only two distinct advantages; (1) it is absolutely without effect upon the renal function, and (2) it gives absolute control over the bladder, so that no matter how inflamed the viscus may be, the surgeon can work at ease with the lower part of the body under control of the intraspinal injection. It is true that these desiderata are often important, but it seems to me that the dangers which accompany the injection of any paralysant into the spinal canal so far outweigh its advantages that it should be resorted to only in very exceptional instances.

Hugh Cabot, of Boston, who closed the symposium, spoke well of Crile's method of anoci-association used in conjunction with nitrous oxide gas and oxygen, the latter combination, however, not being given to patients who have marked circulatory disturbances. He resorts to spinal analgesia when there are bad renal and respiratory complications and sometimes also when there are serious circulatory disturbances.

In the discussion which followed, von Fedoroff, of Petrograd, stated that he had done 230 kidney operations under intravenous hedonal narcosis and that he considers it to be the best form of general anesthesia that can be used in renal cases. Rovsing said he was afraid of the psychic shock which sometimes occurs in operations on the kidneys under

local anesthesia. He believes ether to be the least dangerous of all anesthetics. It is his practise to give a hypodermic injection of morphin half an hour before the operation, though he never gives scopolamin. He prefers to have the ether administered upon an inhaler rather than by the drop method.

The Prevention of Venereal Disease in the German Army. The thoroughness with which the German authorities are endeavoring to reduce the incidence of venereal disease among their soldiers was well demonstrated at a meeting of the Board of the Society for Prophylaxis[1] which was held in April, 1915, about nine months after the outbreak of hostilities. It seems that the trade unions and the national insurance societies are coöperating with special societies for the prevention of venereal disease as well as with the military authorities. The following measures, in addition to those already employed, were recommended:

1. Economic and social provision for unemployed girls and women in the home zone and in the regions where the army is stationed.

2. The closest supervision of private quarters and their restriction to the utmost.

3. The restriction of evening leave of absence.

4. Restriction of alcohol and the ample supply of non-alcoholic beverages.

5. Exclusion of women from employment as waitresses in saloons and from admittance to saloons and similar places.

6. Shortening of the hours that saloons are allowed to be open.

7. Provision of reading-rooms, writing-rooms and gathering places for the soldiers.

8. The prevention of quacks treating venereal disease or advertising their services in any way.

As to the relative value of the different measures actually in use, the most important was considered to be emphatic personal warning to the soldiers of the dangers of indiscriminate sexual relations. For this purpose, an outline prepared by Professor Uhlenhuth, the consulting hygienist for the 7th Army Corps, has proved of the highest value. Placards for use in the barracks and hotels are supplied free of charge by the Society. It was advised that an attempt be made to detain under lock and key all prostitutes in the territory occupied by the army, or to deport them from such territory whenever possible.

The use of personal prophylactics was unqualifiedly endorsed, as their use is the most valuable practical method of protection that can be had. This expression of common-sense is in marked contrast to the order recently given by the Secretary of the United States Navy forbidding the sale of prophylactic packages in the canteens.

The question of preventing the spread of venereal disease by soldiers

[1] Journal of the American Medical Association, June 19, 1915.

home on furlough was discussed, and it was recommended that no soldier should be given a furlough who had not been subjected to a medical examination and found to be free from venereal disease. A long discussion was also devoted to ways and means for preventing the extensive spread of disease through families after peace is declared. As experience has demonstrated that venereal disease becomes much more prevalent toward the end of a war when a truce is declared, it was decided that when such a time arrives all prophylactic measures will have to be enforced with the utmost severity. All those who have been treated for any form of venereal disease during the war should be carefully examined again, and those who are found capable of transmitting infection should be placed under surveillance and treated until they are cured. These measures should be applied, not only to soldiers, but to all other men connected with the army.

Gonorrhea and Its Principal Complications in Soldiers during the First Months of the War. From the first of August, 1914, until the first of January, 1915, 400 soldiers suffering from gonorrhea were treated in Gaucher's service at the Hôpital St. Louis, Paris, and were reported by Bizard, DeClamp and Bralez.[1] This number constituted about one-sixth of all admissions. Many were affected with acute urethritis, particularly the Africans. The conditions were such that they could not be properly treated, and this circumstance, together with the privations to which they were subjected during the first month of the war, served to make their condition very bad, so that upon admission they had profuse discharge, purulent urine, retention, acute prostatitis, cystitis and oftentimes much swelling of the penis. A few days of rest and appropriate treatment, however, invariably brought about rapid improvement in all those who did not have acute epididymitis or other serious complications.

There was another class of patients who for the most part had been infected at some time prior to the outbreak of hostilities, although it is not at all doubtful that some of them had contracted fresh infections. Many, however, denied having exposed themselves. At all events, the disease manifested itself in these patients differently than in those who admitted exposure. Many patients stated that they had been cured of previous attacks for two, three or more years, and that during the interval they had never seen any sign of it whatsoever, and also had never exposed themselves to a fresh infection. The authors believe that in reality these patients had carried foci of infection all this time, and that the privation and severe physical effort to which they were subjected, together with their exposure to the inclemencies of the weather, resulted in an outbreak of the disease. Many of these patients, in spite of the fact that they gave the history of having had

[1] Annales des Maladies Vénériennes, February, 1915.

very little discharge or acute urethral symptoms of any kind, came in with such complications as abscess of the prostate, epididymitis, joint involvement, and even icterus in two cases. It is thought that the trouble originated in the prostate or seminal vesicles, particularly as many of these patients were obliged to ride horse-back.

Argentide for Pyelography. E. L. Young,[1] of Boston, has published the following method for preparing argentide for pyelography:

Quince seed	100 gr.
Water	8 oz.

Macerate for twenty-four hours with frequent agitation. Do not crush the seed. Strain through a cloth and add 2 per cent. boric acid up to 20 ounces. It is important to extract with water and not with the boric acid solution as the latter does not make a good mucilage. Enough of this mucilage is added to 12.5 c.c. of argentide to make 50 c.c., when the mixture is vigorously shaken for two minutes. Shaking is an essential part of the process. The resulting emulsion must stand for several weeks; it is a thin, clear fluid flowing readily through the urethral catheter. It is on the preparation and resultant character of the emulsion that the value of this preparation depends.

[1] Boston Medical and Surgical Journal, April 15, 1915.

SURGERY OF THE EXTREMITIES, SHOCK, ANESTHESIA, INFECTIONS, FRACTURES AND DISLOCATIONS, AND TUMORS.

By JOSEPH C. BLOODGOOD, M.D.

SHOCK.

In Progressive Medicine for December, 1914 (page 169), I critically reviewed the contribution of Frank C. Mann[1] on the Peripheral Origin of Surgical Shock. On December 18, 1914, Dr. Mann wrote me as follows: "Your review of my article contains one criticism which I should like to answer by submitting further data, and one misquotation to which, I am sure, your attention only needs to be called to secure its correction."

First, as to the correction. On page 170 of Progressive Medicine for December, 1914, I quoted from page 212 of Mann's article, his sixth conclusion. My quotation was as follows: "It is *impossible* to produce signs of shock by the use of excessive heat or cold." The quotation should have read: "It is *possible*, etc."

On page 171 (ibid.), in quoting Mann's tenth conclusion, I called attention to the discrepancy with his sixth conclusion. This mistake is mine.

Dr. Mann further writes that on page 172 (ibid.) I wrote as follows: "In this paper the details of Mann's experiments are not given, so that it is impossible to study critically the methods of his investigation."

Dr. Mann, in his letter of December 8, tells me that in the original manuscript submitted to the Dean of the Medical Department of the University of Indiana, the experiments were given in detail, but that the editor of the *Johns Hopkins Hospital Bulletin* was of the opinion that it was not necessary to publish them.

This criticism of mine, of course, amounted to very little. It simply meant that from the standpoint of pure physiology one would have been unable to follow Mann's experiments in the laboratory. The omission, however, cannot be blamed on Dr. Mann, and in a second paper to appear in *Surgery, Gynecology and Obstetrics*, in August, 1915, similar experiments are described in detail.

Dr. Mann further writes: "Concerning your other criticisms I must continue to regard them in the light of personal opinion until

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[1] Johns Hopkins Hospital Bulletin, July, 1914, xxv, 205.

more data are submitted. I should like to point out, however, that the conclusion of Janeway and Ewing are only slightly different from my own."

This experimental work of Mann was performed under the direction of Dr. W. D. Gatch, Professor of Surgery of Indiana University.

Dr. Gatch also wrote me about my critical review in Progressive Medicine: "I was deeply interested as well as greatly surprised at your review of Dr. Mann's article. . . . I believe that if you had read the article more carefully, instead of considering the conclusions entirely apart from the context, you would have agreed with most of the conclusions."

Dr. Gatch writes as follows about Dr. Mann's first conclusion, with which I differed in my critical review:

Mann's Conclusion 1. It is impossible to reduce the anesthetized animal to a state of shock by any degree of sensory stimulation, providing all hemorrhage is prevented and its abdomen not opened.

Bloodgood's Criticism. "In my experience with operative surgery under general anesthesia, in which the condition of the patient has been most carefully recorded and the blood-pressure changes estimated during the entire operation, I have observed extreme degrees of shock in operations other than on the abdomen, even though there had been no hemorrhage. For example, during operation for old, badly united fractures of the shaft of the femur. In these cases the only factors which could have produced shock were the painful stripping of the periosteum and the extreme extension of the limb."

Dr. Gatch's Remarks: "In regard to the first conclusion, this is not new, in fact Porter demonstrated it years ago. Mann demonstrated it beyond a shadow of doubt on fourteen dogs. In all of his cases the most extensive traumatization of the extremities was done, all four limbs being amputated and the limbs avulsed with as much roughness as possible. The skin was burned and skull-cap lifted, and the dura cauterized. All of these manipulations were carried out within a period from four to six hours. The animals' blood-pressure and respirations would show no change from that at the beginning of the experiments, being in as good condition as at the beginning. Of course, the most scrupulous care was taken to prevent hemorrhage. . . . It is interesting that in two cases in this series, in which the signs of shock were developed, we found in one case a large intra-abdominal hemorrhage, and, in the other, an enormous hemorrhage in the legs from fractured bones."[1]

In my criticism, as noted above, of Mann's first conclusion, I simply made the statement that my own clinical experience upon the human being could not confirm Mann's first conclusion.

[1] Dr. Mann writes me that all these experiments were done under ether and chloroform anesthesia.

I am not in a position to confirm or controvert Mann's experimental observations. I gather the impression, however, from what Dr. Gatch writes me of Dr. Mann's experience, that this experimental work should rank with the best that has been done in the various experimental and physiological laboratories. But the very best experimental physiologists have come to different conclusions, and apparently from the evidence of experiments as much alike as it is possible for the different experimenters to make them.

I feel that I must again repeat my criticism of Mann's first conclusion based upon the evidence of his experimental work. It may be true for dogs, but it is apparently not true for the human being.

I have observed extreme degrees of shock in operations in which the abdomen of the human patient had not been opened and in which there had been no hemorrhage.

That is, these patients have shown the same low blood-pressure and the same symptoms which we have called shock when they have been observed in operations upon the abdomen.

I am also sure that the great majority of surgeons will agree with me.

My criticism, therefore, is not of Mann's experimental work, nor of his conclusions from the evidence of this laboratory investigation. I called attention to this conclusion, because I feared that it might create the impression that trauma outside of operations upon the abdomen was not an important factor in shock.

It is quite true that the same degree of shock experienced in operations on the abdomen is apparently much more serious than when observed in operations without the abdomen. It is also true, from my operative observations, that the prognosis of shock not associated with hemorrhage is, as a rule, much better than in shock associated with hemorrhage.

I have an anesthetic chart during an operation which portrays an extreme degree of shock apparently due to an overdose of ether only; another chart recorded during a shoulder-girdle amputation in which there was practically no hemorrhage. The only etiological factors of the shock were ether anesthesia and trauma.

The difference of opinion, therefore, between Dr. Mann and myself is that my clinical observations do not confirm his conclusion 1.

It is fortunate, however, that Dr. Mann has taken up this physiological problem, because there have never been enough well-trained workers interested in this problem.

Dr. Gatch's Remarks: "In regard to the observation of shock during the operation (upon the human being) there are so many causes by which the signs of shock can be produced, and the term is used so loosely that I have found it impossible nearly always to say just what was at fault in a given case. My belief is that the depth of narcosis has more to do with it than any other single factor. My reasons for this are

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set forth at length in a paper[1] entitled 'The Effect of Laparotomy upon the Circulation,' and also in a paper soon to appear in the *American Journal of Surgery,* on the 'Proper Depth of Narcosis.' Mann discusses this point at the beginning of his article, and I am in complete accord with his conclusions that the word *shock* is used almost as vaguely as the word *rheumatism.* The gist of Mann's article is that shock and hemorrhage are practically identical, that experimental shock is simply due to an extensive extravasation of the elements of blood into the peritoneal tissues, that this change is due to a traumatic inflammation, and that the central nervous system has little to do with the condition. Of course, we should use the most extreme care in handling the abdominal viscera. This is not from the danger of nervous stimuli acting upon the central nervous system, but from the danger of traumatic inflammation in the peritoneal cavity."

Mann's Conclusion 4. "The vasomotor centre is not depressed, nor fatigued. It is the most resistant of all vital centres. The peripheral and untraumatized visceral arteries are constricted in shock."

Bloodgood's Criticism: "This must be a very difficult thing to prove or disprove. Crile has always favored the theory of fatigue or exhaustion, Meltzer inhibition, while Howell, from his experiments, is of the opinion that there is more than one factor influencing this centre. Apparently, from the standpoint of pure physiology, the exact relationship of the vasomotor centre to shock seems still to be theoretical."

There also seems to be a difference of opinion among other contributors.

It is because of this difference of opinion that we can feel quite sure that the problem of the etiological factors of shock are by no means solved, and for this reason trained experimental surgeons, such as Dr. Mann, are urgently needed and should be welcomed and aided and stimulated by wholesome and honest criticism.

The clinical surgeon whose day's work brings him into intimate contact with the problems of operative mortality and postoperative complications should endeavor to bring before the experimental surgeon the practical needs. Today in surgery, shock and infection are most practical problems. The clinical surgeon needs help in both.

In the past, many men have been of the opinion that research work in the various departments of universities has for its object simply the search for the unknown, irrespective of the needs of the community in which the university is situated.

In recent years the universities which have apparently made the greatest progress have been those whose research laboratories have worked upon and solved problems helpful to the immediate needs of the people.

[1] Transactions of American Gynecological Society, 1914.

For example, the University of Wisconsin, in its Department of Agriculture, the great development of scientific farming in the Northwest.

The laboratories of physiology in many of our universities have not, as a rule, been interested in solving the problems of immediate need of the medical profession. Fortunately, in recent years in some of the medical schools, special departments of experimental surgery and physiology have been organized, often independent of the older departments, and in these new laboratories the workers have been chiefly interested in the investigation of problems of immediate practical importance to the practising surgeon and physician.

In spite of the fact that physiologists have differed as to the exact etiological factors in shock, their experimental work has been helpful to the surgeon in the recognition, prevention and treatment of the condition.

This explanation of my critical review in the last number of PROGRESSIVE MEDICINE is to be published in *Surgery, Gynecology and Obstetrics*, with Dr. Mann's second contribution to Shock and Hemorrhage. His latest experimental study comes from the Division of Experimental Surgery and Physiology of the Mayo Clinic.

I sincerely hope that these remarks of mine will be satisfactory to Drs. Mann and Gatch.

The Vasomotor Centre in Shock. The editorial writer[1] expresses the opinion that the newer experiments of Seelig and Joseph[2] seem to prove that in shock the vasomotor centre is not only paralyzed, but, on the contrary, is maintaining a tonus in some of the peripheral vessels of sufficient strength to prevent dilatation. This work is in confirmation of Porter's[3] previous conclusions.

Morrison and Hooker[4] have investigated vascular tone and the distribution of blood in surgical shock. The loss of tone may be arterial or venous, or both. There is failure of the venopressor mechanism, stagnation of the venous blood, perfusion of vascular areas.

Shock and Hemorrhage. I have before me the manuscript of an article by Dr. F. C. Mann.[5] The experimental work was done in the new department of the Mayo clinic.

The experiments are described in detail. He writes that as the result of a previous investigation (the one which I have just again discussed) he concluded that shock produced by the exposure of the abdominal viscera was due to a loss of circulatory fluid, the causes for this loss being the same as those producing the stasis which pathologists consider as part of the process of inflammation.

[1] Journal of American Medical Association, May 8, 1915, lxiv, 1588.
[2] Proc. of Soc. of Exper. Biol. and Medicine, 1914, xii. 49.
[3] American Journal of Physiology, 1903–1904, x, 12; ibid., 1910, xxvii, 276.
[4] Amer. Jour. of Physiology, April, 1915.
[5] Surgery, Gynecology and Obstetrics, October 15, 1915, xxi, 430.

It is only fair to insert here that at a dinner with two of the most learned pathologists of this country, I introduced the subject of the inflammatory process and to my surprise found that these two pathologists did not at all agree as to the causes which produce stasis.

I interpose this not as a criticism of Dr. Mann's statement, but simply to bring out here, as I will again later in these pages, that we are beginning to learn that many experts differ widely about things in the sciences which many of us have considered well established.

Mann views the problem in the light that it is necessary to determine whether there is, in shock, an actual loss of circulating fluid, and whether the loss can be accounted for simply by vasomotor failure.

In animals, a certain amount of blood can be obtained from a large artery, such as the femoral. This amount can be considered the measure of "efficient" blood. This efficient blood obtained from the arterial trunk is the amount which can be returned to the heart and lung, and, after aëration, be pumped out to feed the tissues. The blood which can be secured from the venous side of the circulation (right auricle) is the amount that is freely movable, but was not returned to the arterial system. The sum of the efficient blood and that secured from the venous side may be called the mobile blood. When we subtract the amount of the mobile blood from the total amount of blood in the body of the animal, the difference represents the amount of the immobilized blood. This blood in stasis may be looked upon, according to Mann, as useless.

In Mann's experiments the total amount of blood was estimated in relation to the body weight. He admits that the standard is open to certain degree of error. To eliminate this error as much as possible, he worked upon animals of the same type and of the same physical condition, and for this reason concludes that the variation does not materially affect the average.

The technic in all of the experiments was about as follows: The animal is fasted for eighteen hours, etherized and weighed; blood-pressure recorded from the right carotid artery; cannula placed in the right femoral artery. After the manipulations for the production of certain surgical shock were complete, the femoral artery was opened and all the blood possible obtained. Then the chest was explored and the blood removed from the right auricle and cava. The weight of the two amounts of blood were recorded

As stated before, the experiments are described with considerable detail. The following is Mann's summary of these experiments:

1. In a normal dog 66 per cent. of the blood can be obtained from the femoral artery, and 10 per cent. from the heart, making a total of 76 per cent. which can be secured, leaving 24 per cent. in the tissues.

2. In an animal in which the cervical cord is sectioned, producing medullary vasomotor paralysis, 54 per cent. of the blood can be obtained

from the femoral artery and 12 per cent. from the heart—a total of 66 per cent., leaving 34 per cent. in the tissues.

3. In an animal in which the blood-pressure is depressed practically to zero by an overdose of ether, 46 per cent. of blood can be obtained from the femoral artery and 13 per cent. from the heart, making a total of 59 per cent., leaving 41 per cent. in the tissues.

4. In an animal in which the viscera have been exposed until the clinical signs of shock are present, but in which the vasomotor reflexes are as active, or even more so, than in the normal condition, only 28 per cent. of blood can be obtained from the femoral artery and 11 per cent. from the heart, a total of 39 per cent., leaving 61 per cent. in the tissues.

Mann's conclusions are as follows:

The clinical signs of shock which appear after section of the abdomen and exposure of the viscera are due to a loss of circulatory fluid. This loss of fluid is not dependent upon any primary impairment of the medullary vasomotor centre, and takes place at a point beyond the control of the vasomotor mechanism. The causes for this loss of fluid are apparently the same as those which determine the accumulation of fluid in any other irritated area and produce the signs of inflammation. The nervous system probably plays no greater part in the former case than in the latter. The condition is made grave when the viscera are exposed because of the great vascularity of the tissues involved.

Here we have another bombardment of the vasomotor centre theory. These experiments of Mann are interesting along a somewhat new line, but, up to the present, they are destructive rather than constructive. I trust, however, that they will lead to something much more definite and practical.

Psychic Shock. Surgeons with the armies, both at the firing line and at the base hospitals, are observing what they call nervous, or psychic, shock in soldiers who show no gross evidence of wounds. A. von Sarbo[1] seems to be of the opinion that some of these cases are really due to cerebral concussion, that the explosion of the nearby shell causes commotion in the brain tissue and fluids. There seems to be something more than merely molecular changes. Absolute rest is the best treatment. Frequent examinations and any attempt at therapeutic measures other than non-interference and rest seem harmful.

Treatment of Shock. James J. Hogan,[2] of San Francisco, recommends the intravenous employment of a *colloidal (gelatin) solution.* It is prepared as follows:

Purest gelatin	25.0 gm.
Sodium chloride	1.5 gm.
Distilled water	100.0 c.c.

[1] Wiener klin. Wchnschr., January 28, 1915; Journal of American Medical Association, 1915, lxiv, 951.

[2] Journal of American Medical Association, 1915, lxiv, 721

Boil for fifteen minutes in a flask, filter through heavy paper in a hot funnel; place this solution in an autoclave for one hour at 124° C., then chill in an ice-box. This gives the stock solution. When needed, the flask of solidified gelatin is warmed until it melts. Then it is mixed with the following solution: 1000 c.c. of 0.9 per cent. solution of sodium chloride (ordinary normal salt solution) to which has been added 2 grams of sodium carbonate crystals.

It is important that the gelatin should be fresh and of the best quality.

From his clinical experience, he is of the opinion that the best results will be obtained in toxic shock.

Grenade Contusion or Concussion. These dead, shocked, comatosed, or mentally deranged soldiers without evidence of external injury have been observed in other wars, and even in civil accidents, especially explosions. But, apparently, in this war, the number of cases is sufficiently great to excite more than the usual interest and comment. The article by R. Gaupp[1] discusses the psychopathic side chiefly. There are no autopsies. Whatever the exact etiological factors may be, the best results are obtained by rest and the more modern psychopathic treatment by suggestion and mild entertainment. The brain symptom which predominates chiefly is loss of memory. Gaupp is of the opinion that the two most important etiological factors are mechanical, due to the definite shaking or oscillation of the body by the changes in the air pressure due to the explosion, and psychic. He does not attribute much to the transmission of sound or other waves through the auditory apparatus to the brain, nor to poisonous gases which have definite results of their own. There seems no doubt that some cases are purely psychic cases in which all other factors can be excluded, and there seems also no doubt that the cells of the body are disturbed by a definite molecular concussion which may lead to minute hemorrhages and to necrosis of nerve cells, such as definite paraplegia from necrosis secondary to concussion of the spinal cord.

Sir William Osler[2] describes functional nervous disorders under the following heads: Shell-shock Paraplegia, Psychic Knock-out, Involvement of Special Senses, Functional Dysbasia, Functional Spasm of the Leg Muscles.

ANESTHESIA.

The excellent and thoughtful paper of Arthur Dean Bevan[3] presented before the American Surgical Association the past spring, and the interesting and lively discussion, demonstrated a number of interesting facts. In the first place, one could easily see that surgeons were giving

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[1] Beitr. z. klin. Chir., 1915, xcvi, 277.

[2] Journal of American Medical Association, 1915, lxiv, 2001.

[3] Transactions of the American Surgical Association, 1915.

special attention to anesthesia. Bevan's chief contention was, that for different operations and for patients in various conditions, different methods of anesthesia are indicated, and that it should be the endeavor of the surgeon to carefully weigh the evidence, so that the selection of anesthesia would be a factor for the safety and comfort of the patient.

Noone seemed to disagree with this, but when it came to the specific choice, there was a great difference of opinion.

Bevan objected to the routine employment of morphine, morphine and atropine, or morphine and scopolamine before any form of anesthesia. It was his opinion that there should be no mixture of toxic drugs— give ether alone, morphine alone, nitrous oxide and oxygen alone, and use novocaine for local anesthesia alone. The majority of his colleagues were against this sweeping change, and of these the majority favored morphine and atropine.

Nevertheless, I think, this idea of Bevan should be given attention. If Bevan finds this routine hypodermic preliminary to anesthesia unnecessary in his clinic, it is probably unnecessary in others.

On the whole, the majority of surgeons favored ether-drop as the anesthetic of choice. There was not much said about spinal, intratracheal or intrapharyngeal anesthesia.

Not only from this discussion, but from personal conversations with colleagues for a number of years, I know that Crile's closest colleagues— those who have seen most of his work—do not accept the entire theory or practise of anoci-association, and recently there has appeared an article by Baldwin,[1] of Columbus, Ohio, in which he contends that Crile's theory of shock has neither been confirmed in the laboratory by others, nor on the operating table by surgeons. That is, Baldwin expresses the opinion that local anesthesia in combination with general anesthesia does not diminish the shock, other things being equal.

There is bound to be this difference of opinion. In fact, a certain amount of skepticism of the views and practises of the representative surgeons of this country is not a hindrance to progress. Nor is the wide-spread acceptance of a theory or practise an indication of its infallibility or correctness. Popular things "take" in spite of their intrinsic value, at least temporarily; unpopular ones, of real value, are often adopted, but slowly.

The wide-spread employment of iodine for the disinfection of the field of operation was due to the simplicity of the method; it saved time and effort. Fortunately, up to the present time the results seem to be as good as our previous well-developed methods. But it took years before surgeons would wear gloves, and much of this was due to the fact that the gloved method added to the difficulty, was more expensive, and many surgeons were of the opinion that it interfered with their sense of touch.

[1] American Journal of Surgery, August, 1915.

Here efficiency won out. But it took far longer to introduce gloves than to introduce iodine.

The history and the literature on anesthesia, which I have attempted to cover in the pages of PROGRESSIVE MEDICINE since 1899, show the difficulty encountered in substituting ether for chloroform as the general anesthetic of choice. For years those who advocated chloroform published results which seemed to demonstrate that it was just as safe as ether. Many surgeons of large experience honestly believed that chloroform was just as safe as ether. Many of these surgeons have changed their minds. The followers of most of them use ether.

Gas and oxygen in the beginning were given greater attention and employed more generally, because its administration is somewhat spectacular; it required an expert to give it, and patients, having read about it, wanted it. But these factors now are somewhat dimmed by time, and this general anesthetic must stand on its own merit. In Dr. Halsted's clinic in the Johns Hopkins Hospital, and in my own clinic at St. Agnes' Hospital, nitrous oxide-and-oxygen anesthesia is not employed as frequently as previously. In my clinic I have gradually allowed the return to ether in a certain number of cases, because I was anxious to compare again the two methods. I am inclined to think that my associates, on the whole, prefer ether. Nitrous oxide and oxygen is more difficult to administer than drop-ether. Under this anesthesia the operation is more difficult for the surgeon, and in many operations local anesthesia must be combined with it, irrespective of the relation to shock.

The operation requires more time. In a busy operating-room, with a recurring long day's work, I find it difficult to keep up the enthusiasm of the team for the more difficult technic of nitrous oxide anesthesia, and the longer and more difficult operation under its combination with local anesthesia. Cases of death are so rare that the younger men are not often influenced by the mortality, nor are they old enough to appreciate the differences in postoperative convalescence and the period of disability.

This difference of opinion as to the choice of anesthesia and the non-acceptance of Crile's theory and practise of anoci-association impresses me as an indication of great improvement in anesthesia and operative technic in this country. Ether-drop is being given better, the majority of surgeons are operating without hemorrhage, with less trauma, and with better judgment, and we are getting our cases earlier. Naturally, the mortality is lower, and all the other complications are diminished.

As far as I am able to judge from my personal observation, there is something real in the combination of local anesthesia with any form of general anesthesia. Kroenlein demonstrated this years ago in his operations upon the jaw and mouth. He did these operations under very light general anesthesia and practically eliminated pneumonia in

operations of this kind. I know from my observations on operations by colleagues in other clinics, that the introduction of deep narcosis through intratracheal anesthesia has again increased the mortality of jaw and mouth operations. I wish to emphasize here again that local anesthesia has its distinct place in operative technic, and it is a question whether it should not be employed in every operation, if possible.

In conjunction with general anesthesia, it undoubtedly diminishes the amount of the toxic substance used.

Whether we agree with Crile's fully developed theory of shock and anoci-association or not, we must all give him credit for his profound influence in the improvement of anesthesia and gentleness in operative technic, and our more comprehensive conception of shock which has led to a distinct preventive treatment.

FIRST–AID CONFERENCE.

This Conference met in Washington on Monday and Tuesday, August 23 and 24, 1915. The membership was composed of chief surgeons of railroads, mines and manufactories, and general officials of the companies represented by their chief surgeons; civil surgeons representing national surgical associations, and representatives of the medical departments of the Army, Navy and Public Health Service, and a representative of the American Red Cross. There were also representatives in this conference of the manufacturers of supplies necessary for first-aid packages, etc.

The letter calling this conference together was dated July 3, and read as follows:

"Dear Doctor:

"A meeting of chief surgeons and other representatives of railroads has been suggested and arranged to be held in Washington, D. C., at the New Willard Hotel, on the 23d and 24th days of August, 1915. Surgeons and representatives of those employing labor in other pursuits will also be in attendance.

"The object of this meeting is to bring civil surgeons interested in the surgery of accidental wounds and the employers of labor together with representatives of the medical departments of the Army, Navy and Public Health Service.

"For the past year a special committee in Washington has been investigating first-aid methods, newer methods of fixation and better methods for the handling and transportation of injured persons. This committee of Army surgeons has investigated the problems, especially in relation to military surgery.

"It has occurred to those interested in this subject that the methods found most applicable to military surgery will probably also be the best methods for accidental surgery in industrial pursuits. There seems no

doubt that, if a representative body of surgeons could establish a uniform manual on the surgery of accidental wounds and a uniform first-aid package, uniform splints and methods of fixation, and uniform methods of transportation, it would not only be very economical, but it would also add to the efficiency of surgery of accidental wounds received in all kinds of industrial pursuits. If all the railroads of this country and all the employers of labor should adopt this uniform system and begin at once its application to the treatment of accidental injuries, it would allow a large number of surgeons to test better the efficiency of this uniform system, and from time to time make important changes, if found necessary.

"At the present time there is no uniform first-aid manual, no well-established text-book on the surgery of accidents in civil life, and no first-class book on military surgery. First-aid packages and measures of fixation, splints and transportation methods not only vary in the different medical departments of the Army and Navy, but also in the different armies of the various nations now at war.

"This meeting therefore will be for the discussion of these problems with the hope that such a uniform system can be inaugurated and adopted throughout the country. It is proposed that there be no set papers, but that for two days there shall be an informal discussion, and then committees can be formed to correlate different views, and, if possible, establish these uniform methods.

"It is very important that not only the surgeons of railroads of the country be there to represent their companies, but also that some general officials (say, representative of the claims, or legal, departments) with knowledge of the importance and economic value of the care of injured employees. . . . ''

The topics for discussion as given out in printed form were as follows:

Topics for Discussion.

Uniform, standardized, first-aid materials:
   A. First-aid package for individuals.
   B. Larger packages for reserve in cars, ambulances, etc.
   C. Fixation dressings.
   D. Special dressings for burns and crushed wounds.
To be discussed by surgeons of railroads, mines, manufactories, etc.:
Is a scheme of this kind practical to be uniformly employed throughout a great railroad system?
First-aid packages for every man.
Large dressings to be kept in cars and stations.
Is a scheme of this kind applicable to mines, manufacturers, and other employers of labor? If applicable, what would be its economic value?

To be discussed by lay officials of industrial corporations:

Could a uniform method and standarized materials applicable to the treatment of accidental wounds in peace be made applicable to the treatment of wounds in war?

If railroads, mine owners, manufacturers and other employers of labor should adopt a scheme of this kind, would it be helpful to the government in its preparation for the emergencies of war?

To be discussed by surgeons of the Army, Navy, and Public Health Service:

If railroads, mines and other large industrial corporations adopted this uniform method and material, would it reduce the cost of producing such materials, as it would be demanded in much larger quantities and of a definite, uniform standard in regard to quality, size, etc.?

To be discussed by representatives of manufacturers of first-aid supplies, drugs, and sera:

If all the agencies described above agree to the importance of this uniformity in, and standardization of, first-aid materials, and should the general officials of railroads, mines, etc., agree to introduce them through the aid of their medical departments, and should the manufacturers of these materials agree that their cost will be very much reduced by such a method, would the medical departments of the Army, Navy and Public Health Service agree to appoint a permanent board, or commission, for the purpose of selecting the best uniform first-aid methods and materials, such board to call for consultation and aid wherever it deemed best?

First-aid Package. Sterile, or antiseptic gauze?

Character of gauze pad and bandage?

Shall the von Esmarch triangular bandage be retained?

Shall the first-aid package contain adhesive straps and safety pins? Shall it contain any antiseptics, such as iodine? Should it be packed in a metal box?

What would be the lowest price for such first-aid packages in large quantities?

How long will adhesive straps retain their adhesive properties in a sealed metal box?

What should be contained in the larger reserve packages?

What are the best materials for the fixation of fractures, etc., at the first (emergency) dressing?

What special dressings should be prepared in a scheme of this kind for crushed wound? for burns?

What is the best form of stretcher applicable to railroads, etc.?

Should provision be made for the treatment of shock?

Would it not be possible to have a uniform case for surgeons which will equip them for emergencies of this kind which could be kept in easily accessible places?

Surgeon-General Gorgas of the Army was selected as permanent chairman, but during the meetings Surgeon General Blue, Col. Battle of the Norfolk and Western Railway Co., Dr. Le Conte of the American Surgical Association, Dr. Eve, of Nashville, and Dr. Wainwright, of Scranton, the two latter chief surgeons of railroads, presided. On Monday evening, Dr. Harvey Cushing, of Harvard University, gave a lantern-slide talk of his experience in the American Ambulance Hospital in Paris and with the transportation of the wounded from the French lines. Tuesday noon, Dr. George Crile, of Cleveland, also with lantern slides, gave his experiences in the same regions.

The conference demonstrated the correctness of the statement made in the letter which called the conference together.

After a thorough discussion in which practically everyone took part, the great purpose of the conference was accomplished in the unanimous passage of the following resolution:

This resolution was drafted by Dr. W. C. Rucker, of the Public Health Service, Dr. Estes, of Pennsylvania and Major Patterson representing the American National Red Cross.

Resolution of the First-aid Conference to be Submitted to the President of the United States.

"WHEREAS, There is a great lack of uniformity in first-aid methods; in first-aid packages, and in other first-aid equipment; and in first-aid instruction, and

"WHEREAS, Many of the aims of first aid are defeated thereby and needless suffering and expense incurred,

"*Therefore be it Resolved,* That this Conference recommends to the President of the United States that he appoint a "Board of First-aid Standardization," said Board to consist of one officer each from the Medical Corps of the United States Army, the Medical Corps of the United States Navy, the United States Public Health Service, the American National Red Cross, the American Medical Association, the American Surgical Association, and the Association of the Railway Chief Surgeons of America; this Board to deliberate carefully on first-aid methods, packages, equipment and instruction, and to recommend a standard for each to a subsequent session of this Conference to be called by the Permanent Chairman; the creation and maintenance of the said Board to be without expense to the United States."

Undoubtedly this will be accepted by the President of the United States and a Permanent First-aid Board will be established.

This in more than one way is a very important thing to do.

In the first place, next to "safety first," instruction in, and provision for, first-aid measures will undoubtedly influence the discomforts, disabilities and even mortality of wounds.

If it is made uniform and the material is standardized, it can be done economically.

As two or more States have passed laws compelling railroads and other employers of labor to provide first-aid material and instruction, the probabilities are that other States will follow. Done in this way there will probably be little uniformity. If this First-aid Board does its work properly, there will probably be no necessity for further laws, or should States pass laws, they will probably follow suggestions of this Board. But it seemed to be the consensus of opinion that if the medical profession would really agree upon a uniform method there would be no necessity for a law to enforce it. The employers of labor desire this protective provision for their employees.

After adopting this resolution, the Conference decided to make itself a permanent organization, at least until the Board of First-aid Standardization reported.

There seemed some good reason for this, because the composition of the membership of the First-aid Conference could not be duplicated by any other surgical association, as it brought together all those interested in accidental surgery and first-aid.

Before the meeting of this First-aid Conference there was sent to each representative a pamphlet discussing the more important points which should be considered. The following are abstracts from this pamphlet:

"**Military Wounds.** At the present time the only protective serum for any of the infections in accidental wounds is the antitoxin for tetanus.

"Even should other sera be discovered which would protect against the pyogenic cocci and the gas bacillus group, there would still remain in the accidental wounds and wounds in warfare the problem of the first-aid dressing (including general and local treatment), fixation, and transportation.

"In operation wounds, the experienced surgeon and his trained assistants make the wound under all the safeguards of asepsis, hemostasis, and all the preventive measures against shock.

"In accidental wounds and wounds in warfare, little can be done for the prevention of infection, except perhaps personal cleanliness which is often impossible in war and difficult in many occupations.

"'Safety first' is, of course, one of the most important attempts at the prevention of accidents.

"Accidental wounds and wounds in warfare are treated by five distinct groups of individuals:

"1. The injured persons themselves.

"2. Untrained 'good Samaritans.'

"3. Partially trained individuals, such as the hospital corps men in war, and the trained nurse in accidental wounds.

"4. The physician of ordinary training and experience.

"5. The experienced surgeon."

The treatment by the individuals in these five groups is modified by the available material for such treatment and the place at which the accident has occurred, or the wound is acquired. The trained surgeon, and more so the physician of ordinary training, are most handicapped by lack of proper material and environment.

If every accidental wound and every wound sustained in war could be brought in a few moments, or, at the longest, a few hours, to a modern hospital and placed under the care of an experienced surgeon, most of the difficult problems of first aid would be solved. The therapeutic problems would be purely surgical ones.

Even if every accidental wound and wounds sustained in war could be thus brought to a modern hospital under the care of an experienced surgeon, there would still be some unsettled questions; for example, Can we disinfect with the antiseptics now employed for such wounds, if we are given the opportunity a few hours after the injury?

In accidental wounds and wounds in war there are always the problems of the first dressing of the wounds, the first treatment of the patient, the immobilization of certain wounds of the extremities, and the transportation of the patient to a better environment, especially to a modern hospital.

In considering what shall be done about the dressing of the wound, the treatment of the injured individual, the fixation of the injured extremity and transportation, we have to bear in mind, first, Who is there to do it? Second, What materials are there with which to do it?

In war, it seems to be the consensus of opinion to provide every soldier with a first-aid package which contains a sterile dressing. The soldier or a comrade has been instructed how to put on this dressing. He is also instructed not to touch the wound with anything except the dressing. All authorities seem to agree that the soldier should be instructed to do this and nothing more.

Some recent authorities would place in the first-aid package iodine with instructions how to paint the skin about the wound with it. In the new first-aid package of the U. S. Army, the Tuttle iodine swab is included.

Some authorities would instruct the soldier how to put on some form of an Esmarch bandage above the bleeding-point on the extremities, or how to check hemorrhage by pressure.

There seems to be agreement, therefore, that all soldiers should be provided with a first-aid packet which should contain sterile gauze with bandages; they should be instructed how to apply this bandage without touching the wound. Except for this everything else should be non-interference.

Beyond this the authorities disagree. Perhaps there is a majority

in favor of iodine, but apparently in the past few years the majority is against any instructions as to the treatment of hemorrhage by any form of Esmarch bandage in the hands of the injured individual, or the untrained "good Samaritan."

In war surgery the hospital corps man is instructed not only on what the soldier is instructed, but, in addition, all authorities agree, he should be allowed to use some antiseptic, among which at the present time iodine or alcohol seems to be favored most.

Many authorities feel that even a partially trained hospital corps man should not be allowed to use any form of constricting band for hemorrhage.

Many authorities feel that the hospital corps nurse should be furnished with morphine and a hypodermic syringe with instructions how to use it.

The majority of authorities seem to be of the opinion that in the absence of the surgeon, the hospital corps man should be instructed how to immobilize injuries of the upper and lower extremity, and how to superintend the transportation of the injured soldier.

When the physician of ordinary training and experience sees the injured soldier very quickly after the infliction of the wound, the consensus of opinion favors that his interference should be no greater than that by the hospital corps man.

It is presupposed, however, that what the surgeon would do for the injured would be done better.

Many authorities, however, are of the opinion that this surgeon should carry a few instruments and materials for disinfection which would allow him in case of urgent necessity to enlarge the wound, clamp a bleeding vessel and apply a ligature, if possible; to perform tracheotomy, to close an open pneumothorax, to reduce eviscerated intestines.

But this would mean that in the large majority of cases the actual treatment of wounds of war on the firing line by the surgeon would be non-interference with the wound—simply first dressing, immobilization, transportation.

When we come to what the experienced surgeon should do, there is no hard-and-fast rule. He should do what he thinks best. But there is a growing opinion that the experienced surgeon supplied with a very simple outfit would be able to do much in gun-shot wounds very quickly after the infliction of the wound, providing the environment of the battle gave him any opportunity at all.

There is no doubt that the experienced surgeon could much better immobilize injuries of the lower extremity and dress large shell wounds.

In war, we can provide every soldier with a first-aid dressing.

We can provide the ambulance corps and the means of transportation to the base hospital.

The greatest difficulty is to get at the wounded during the battle—

they may have to lie for hours with no treatment, except that adminis-
tered by themselves or by their comrades.

For treatment at or near the firing line, bulky material for dressing
cannot be provided, so all material for fixation must be of the simplest.

Transportation from the firing line varies with the character of the
ground and the range of the enemy's fire.

To transport the injured soldier to the environment of a partially
equipped hospital under the care of trained surgeons in some instances
is simple, in others apparently impossible.

Accidental Wounds. The problems in accidental wounds are much
less difficult. The majority of injured people, especially in cities, are
picked up and taken to the hospital by the nearest automobile, and
thus reach the proper environment and an experienced surgeon often
in less than one hour. Nevertheless on railroads, in mines, and even in
some manufacturing plants, this rapid transportation to the nearest
hospital is not possible.

There seems no doubt that, even in accidental wounds in time of
peace, there is a large opportunity for the application of the principles
of first-aid dressings, immobilization and transportation.

The economic side of this is as strong as the humanitarian. The
earlier the first treatment, the better the immobilization, and the more
careful the transportation, the shorter the period of disability and the
less the loss of function.

In formulating the principles of first aid for accidental wounds, we
must construct uniform rules as to what the injured individual should
do, what the partially trained individual should do, and what the
physician and the surgeon should do.

The fireman on a limited train who burns his hand is very much in
the position of the soldier shot on picket duty. It may be four hours,
or more, before he could get the wound dressed. Why should not this
fireman by supplied with his first-aid package and instructed how to
use it?

In case of an accident to a passenger train, why should not the train-
men, and even the passengers, know something about first aid methods,
and why should not the cars carry first-aid material?

This idea of a workman injured when alone, or of a large number
of wounded in a disaster can be carried out through all industries, and
even further, through all walks of life in time of peace.

The chief fault with first aid is that there has been little or no instruc-
tion outside of the army and Red Cross. Even where instruction has
been given, it has not been uniform. There is room for the adoption
of a uniform scheme of instruction which should be backed by the
highest surgical authorities of this country.

First-aid dressings, materials for fixation, stretchers for transportation
—all vary to a considerable degree. This lack of uniformity is confus-

ing even to the experienced physician or surgeon. Even in modern hospitals there is no uniformity in materials and methods.

The problems are the same, and, if we get together, there is no reason why we should not settle upon a uniform set of rules for what should be done in time of accidents in the various environments.

There is no reason why the material for first-aid dressing should not be uniform. This, in addition, would make it less expensive.

A large number of first-aid books have been published—all contain excellent material, but all contain enough which renders them confusing even to the experienced surgeon, and these manuals are not supported by the authority of the modern surgeons of this country. In fact, it would be very difficult at the present time for anyone who desires to write a first-aid manual to do so, if he consulted the most experienced surgeons individually.

The surgeons, therefore, must come together for a conference on their experience and views, with the hope of establishing uniformity and standardization.

The motto of this First-aid Conference should be: Uniformity in methods, standardization of material, fixed and uniform rules for all under ordinary circumstances, without interfering with the surgeon's liberty of action as far as initiative toward better methods is concerned.

It will probably be impossible in this First-aid Conference to get more than an exchange of ideas and to impress upon ourselves as surgeons the necessity for such an attempt at uniformity and standardization.

This Conference should lead to a resolution requesting the Government of the United States to appoint a permanent board composed of medical officers of the Army, Navy and Public Health Service, the members of this board to give their entire time to the work and to have power to select consulting committees. It would probably be a good plan to have many of these committees suggested by the national surgical associations.

The second object of this Conference is to demonstrate to the general officials of railroads, mines and manufactories the economic value of the adoption of such uniform and standard methods by their various corporations under the supervision of their medical departments.

If this permanent board, with its consulting help, should formulate the uniform rules of first aid, uniform methods, and suggest the standard materials, and should this be adopted by the majority of railroads, mines and manufactories of this country, it would require but little imagination to see the good effect of this on the results of accidental surgery, and there is no doubt that not only would this be the best thing next to "safety first" in time of peace, but it would also mean a most efficient preparation for wounds in war.

After the first resolution was passed it was followed by a second, to publish the discussions in the form of Transactions.

The third resolution represents a very interesting attempt to get quickly from a very large number of surgeons an expression of their opinion and experience on the five most important points in first aid, fixation and transportation.

The following letter will be sent to chief surgeons of railroads, mines and manufactories with the request that they mail copies of the letter to the surgeons under their supervision. The letter is as follows:

"DEAR DOCTOR:

"The following resolution was passed at this meeting: 'That the questions noted below be sent to the Chief Surgeons of Railroads, Mines and Manufactories, first, to be answered by them; second, that a copy of these questions be sent by the Chief Surgeons to their Associate Surgeons.'

"The object of these questions is to attempt to get the opinion and experience of a number of surgeons and to formulate them for publication.

"Please answer each question on a separate sheet of paper and sign your name to each sheet.

"1. What has been your experience with the most available first-aid package and dressing for small and large wounds; for different kinds and degrees of burns?

"2. What has been your experience with the immediate employment of antiseptics in accidental wounds; what antiseptic have you used, in what strength, and how applied? Have you employed tincture of iodine; if so, how and what have been the results?

"3. What, in your experience, has been the most efficient and most readily applied method of fixation for injuries of the (*a*) upper and (*b*) the lower extremity?

"4. Have you considered the construction of a stretcher, which, in addition to serving as a means of transportation of injured, will have appliances for the fixation of the upper and lower extremity, somewhat along the lines of a Bradford splint, or the Gihon naval splint?

"5. Please state your views on some liquid ointment dressing which would be available for first aid in large wounds and burns with the object of preventing the usual dry-gauze dressing adhering to the wound and rendering subsequent dressings painless.

"These questions have been sent to all the members of the Association of Railroad Chief Surgeons of America, and a few other surgeons.

"Please give these questions your personal attention, first, and mail your answers to the Secretary, at the same time writing him and giving him the number of copies of these question sheets desired to mail to your Associate Surgeons."

As I was present at this meeting and acted as its Secretary, I am in a good position to give a summary of the views there expressed.

Many of the surgeons attending this conference have written very

little, so their unusual experience and well-thought-out ideas on the treatment of accidents are not available to the reading public. Unfortunately, this is often true—the men in surgery whose opinions and experience we want most, often write least.

The majority of surgeons advised against giving individual first-aid packages to railroad employees. Their experience was that it is a waste of material. The first-aid packages and other first-aid material should be placed on the engine, in the caboose of the freight train, in the baggage cars of all trains, and perhaps in the passenger coaches. It should be in the stations and shops. In these localities it is about as quickly available as when carried by the men. Miners, and other laborers whose occupation is at some distance from a base at which first-aid packages could be conveniently kept, should carry them on their person.

In civil life, therefore, the probabilities are that, except in a few instances, the first-aid packages will be kept in a convenient place and not carried by the laborer as it is by the soldier.

It seemed to be the consensus of opinion that this first-aid package and material should be more widely distributed. This idea has been carried out by the American National Red Cross who have made up first-aid boxes for homes, for automobiles, for railroads, mines, manufactories, fire departments, police, etc.

The difficulty of losing the first-aid package is by no means overcome when it is placed conveniently and not given to the individual to carry. Many railroad surgeons gave examples of how the first-aid material disappeared. In the caboose of a freight train the box was found more convenient for tools and nails; the stretcher in the station was usually taken home by the section boss to be used as a cot-bed. Everyone knows that we have had the same experience in the past with fire buckets and other provisions for the emergency treatment of fires.

It seemed to be the consensus of opinion that discipline on railroads, in mines, and among the employees of manufactories was much more difficult to maintain than in the army. But in all of these industries the men are given other property to care for and are held responsible for it, and the probabilities are that when this propaganda on first aid is thoroughly understood, the difficulties of preserving first-aid material and packages will be overcome.

Dr. J. P. Kaster, Chief Surgeon of the Santa Fe System, gave his experience as a pioneer in first-aid measures. Almost twenty-five years ago this railroad had attempted to equip its entire system with what was then looked upon as the best methods of first aid. Stretchers and first-aid packages and boxes were properly and uniformly placed throughout the lines. In one year almost everything had disappeared without coming in contact with wounds.

This side of first-aid measures must be given considerable thought,

otherwise all efforts will be unavailing. We may be able to standardize first aid, to get the surgeons throughout the country to accept this standardization, to influence the employers of labor to shoulder the expense of the equipment. But then comes the problem of teaching the people how to preserve this equipment for emergencies and how to use it when the emergency arises.

This is by no means a new problem, it is a very old one, and we are meeting it now every day in preventive medicine. Fortunately, it should become easier, as people are being educated. The propaganda against tuberculosis has been quickly followed by that for the control of cancer. It is my opinion that this is the psychological moment for the national propaganda on standardization of first-aid measures and instruction.

It was the consensus of opinion that the first-aid package should be composed of sterile gauze, and no antiseptic should be placed in the first-aid kit. Yet, there were some good special pleas for iodine. Many were of the opinion that iodine could be placed in the first-aid package in such a form that it could be employed without any danger; for example, the Tuttle iodine swab, as recommended by the Army Board, but not yet adopted.

Dr. Chas. H. Lemon, of Milwaukee, who has had a large and long experience with employees of electric railroads, expressed the opinion that these people have a fixed idea that something besides dry sterile gauze must be placed on the open wound or cut. If it is not supplied in the first-aid package, they will find something of their own to put on. Lemon gives them a small bottle of arnica which, we know, is a weak solution of alcohol, harmless, yet slightly antiseptic. It is my personal opinion that some form of antiseptic in the first-aid package will eventually win out—either 70 per cent. alcohol, or 10 per cent. iodine.

But this by no means settles the question of the first-aid package.

After the above was written, my attention was called to a communication of the Royal Society of Medicine of London, on the Standardization of the Treatment of the Wounded.[1] Sir Almroth Wright pointed out that the army surgeons, especially between the firing line and base hospital, saw their patients for such a short time, that they were unable to profit by their experience and learn the best method of treatment. It was his opinion that the older and consulting surgeons should collect data, draw conclusions and issue them in the form of instructions to the younger group. This so-called conference has already been started by some British surgeons at the front. This conference from time to time sends out its instructions to the surgeons on any improvement in treatment. As a rule, it is sent out in the form of a pamphlet or leaflet.

I look upon this as evidence in confirmation of the idea of the First-aid Conference.

[1] Jour. Amer. Med. Assoc., 1915, lxv, 184.

WOUNDS.

Military Surgery. LOCAL EFFECTS OF INJURY. Never before, probably, in the history of the world have surgeons had a greater opportunity to observe the general and local effect of injury in the various types of gun-shot wounds as in the present war, and, in addition, they are getting an experience with infected wounds which had been growing less and less in civil practice.

American surgeons have been especially interested in the American Ambulance Hospital and Service in Paris. There was a symposium[1] on Military Surgery in this Hospital on February 5.

Alexis Carrel[2] expressed the opinion that the art of destroying and the science of manufacturing explosives had advanced to a high degree of efficiency, while medical and surgical science had done very little, especially in advancing the treatment of infected wounds of war.

It is to be remembered that in war the majority of wounds are received on the firing line. They must receive treatment here and then be transported back to the first dressing station or field hospital, to the division and then to the base hospital. By the time they have reached the hospital in which it is possible to apply all the means in the art and science of medicine, things have happened in the wound and in the general condition of the patient for which, at the present time, surgical science and art offer but little. Carrel states that in the first place the wounded should be brought to a place where they can be properly cared for as soon as possible after being wounded. This would diminish the need for amputation and would reduce the death-rate. But that is not sufficient. No matter what is done, with our present knowledge and skill, it is impossible to prevent infection entirely. What is needed is to study the conditions and cases carefully in order to find new methods by which we may be able to handle these cases successfully. Old methods of treatment have proved ineffective, and the only hope for the future is to find new methods. No doubt, in our researches and study of these problems, we shall arrive at different conclusions, but no matter from what direction we approach the problems, their solution will be found only by the combined labors of trained men working together to this end.

Dr. Carrel has been at the front from the beginning of the war and has probably had as large an experience as any other surgeon in this war, and he concludes that it is impossible to prevent infection entirely and that old methods of treatment have proved ineffective, and the only hope for the future is to find new methods.

This may be true, and I am not in the best position to criticize his statements. But recently I have given considerable thought to this

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[1] Surgery, Gynecology and Obstetrics, 1915, xx, 708.
[2] Ibid., p. 710.

subject and I have come to the conclusion that civil surgeons of the younger generation know very little about the treatment of infected wounds. The experience in the average civil hospital is with clean operative wounds which do not suppurate. The majority of accidental wounds in civil practice reach good hospital attention in such a short time that infection and suppuration are the exception rather than the rule. For this reason the civil surgeon has little experience and, as a rule, is not familiar with the established knowledge of the older generation of surgeons who have had large experience with infected wounds and who obtained good results with their methods of free drainage, frequent dressings, and antiseptics. The majority of surgeons at the front today belong to the younger generation and probably have not prepared themselves for this new demand.

In the second place, we would naturally ask the question, whether our methods and our knowledge (not only of this generation, but of the older, more familiar with infections), if we could apply them to the treatment of wounded shortly after the injury, would not be sufficient to accomplish results. The fault with the results in the wounded of this war is that, in the majority of cases, they cannot receive attention at once. They lie for hours in the dirt of the trenches; first-aid dressings, even when applied, are immediately made ineffective by the soiling with the trench water or the muddy ground. In view of the tremendous range and activity of the artillery fire, any further care of the wounded near the firing line is difficult, transportation is not only difficult, but must be slow. The fighting between these entrenched camps is so intense that often all means of transportation to and from the firing line are exhausted by the demand of the battle. So that when the wounded finally reach the base hospital and come under the care of the experienced civil surgeon, wound conditions are encountered with which modern surgery has had no experience. We have had no stimulus to develop methods for such conditions. In this sense, Carrel is undoubtedly correct, and all the other surgeons in this war emphasize infection. It was hoped that modern first-aid methods with immediate iodine disinfection, better fixation and transportation, would make infection the exception rather than the rule. But, in the past, army surgeons had based their opinion on rifle wounds; artillery had not been developed to the extent it is now. The shrapnel wound is larger, into it more foreign bodies enter, it is almost impossible to properly dress it on the firing line, and with every hour until the wounded reaches the hospital the extent and danger of infection increases.

Sir Almroth Wright,[1] in his discussion, emphasizes the importance of reinvestigation of the bacteriology of wounds. So far, he has found that in the infected gun-shot wounds of this war the ordinary pyogenic

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[1] Surgery, Gynecology and Obstetrics, 1915, xx, 711.

staphylococci and streptococci are by no means the most common invaders. They have found entirely different series of anërobic microbes of which the Welch bacillus (gas phlegmons) was one of the most common invaders. Mixed infections are common and often of a very serious nature.

The large opening of the wounds, their treatment with strong antiseptics, with iodine and carbolic solutions, has apparently failed. (It is to be remembered that, in the experience of Wright and others, this surgical treatment of the infected wound has usually been a late, and not an immediate or early, intervention.)

As Sir Almroth writes, the closed, infected wound is simply changed into an open wound which continues to be infected and continues to suppurate in spite of the large incision and free drainage.

This authority recommends, in addition to drainage, what he calls *lymph lavage*. The open wound is treated with some form of fomentation (according to the suggestion of Bier), which produces active hyperemia. Wright employs a hypertonic solution consisting of 0.5 per cent. of citrate of soda and a 5 per cent. salt solution.

This is simply the application of an old, well-established surgical principle, that open wounds do better under moist dressings than under dry dressings.

Wright is also of the opinion that in many patients this is not sufficient. These individuals lack antibacterial substances of their own, and for these cases, in addition to the open wound, free drainage and lymph lavage by moist dressings, vaccines should be employed.

The prophylactic vaccine should first be against the Welch gas bacillus, later against the Staphylococcus, Streptococcus, and Bacillus proteus.

Antisepsis alone seems to have failed.

Wright also emphasizes another important point which, however, is by no means new to surgeons with any experience with infected wounds, and that is—frequent dressings. The moist dressing should be changed every two or three hours; in some cases the wounds can be placed in continuous baths.

However, up to the present time Wright is unable to give any definite facts as evidence in favor of the value of vaccines.

Open wounds, moist dressings with frequent changes, with or without antiseptics, is a treatment almost as old as surgery.

The efficacy of this treatment probably depends upon the time of its application. If it is impossible in war surgery to employ these means at the proper time, the hope for better results in infected wounds must depend upon some new weapon—antisepsis applied in a different way, vaccines or serum.

Professor Theodore Tuffier,[1] in the discussion of the problem, men-

[1] Surgery, Gynecology and Obstetrics, 1915, xx, 713.

tions two factors—shock and infection. The degree and type of shock vary. Shock may be observed when there is no external wound.

Infection probably takes place at the moment of the injury. In this present war, infection is greater on account of the dirt from which the soldier cannot escape in the trench. Under these circumstances ordinary first aid and external disinfection fail.

Tuffier is of the opinion that we need a new antiseptic which will penetrate to the deepest part of the wound. The probabilities are that this cannot be applied on the firing line.

For this reason the ordinary methods of transportation and the ordinary sequence of hospitals fail to meet the requirements.

The hospital equipped to meet the necessity of this treatment must be moved nearer the front, and a method of transportation must be devised which will shorten the time which elapses between the onset of the wound and this efficient treatment.

Automobile ambulances have undoubtedly partially met this requirement. Carrel has moved his base hospital from the South of France to nine miles behind the firing line.

Tuffier also discusses the control of pain. The wounded soldier should receive morphine before and during transportation, and every endeavor should be made to immobilize the injured part and to carry the injured soldier as comfortably as possible.

However, as we move the base hospital nearer the firing line, we are confronted with two dangers—first, the actual danger of shell fire; second, the psychological effect upon the injured soldiers by the noise and the confusion which cannot be eliminated when in proximity to battling armies. Rapid, efficient transportation may be able to bring the base hospital nearer the firing line in point of time, yet remove it to a distance in which these dangers are reduced or eliminated.

Tuffier discusses transportation by boat, by train and by automobile.

In a paper by Sir Berkeley Moynihan[1] we have the observations of the field consultant. The following points are emphasized: Most of the wounds when examined at the base hospital are in a septic condition. The few not infected are rifle-ball wounds. Unfortunately, in the present war this kind of wound, which was formerly in the majority, is now in the minority. Sir Berkeley is of the opinion that antisepsis has failed and is perhaps of little more value than ordinary water. There must be some new treatment to meet the new conditions. The ordinary dry dressing, or moist dressing allowed to dry, becomes a septic focus. Constant dressing, immersion, moist dressings, frequent irrigations, or leaving the wound exposed to the air give better results than any form of antiseptic dressings with infrequent change of dressings.

[1] Surgery, Gynecology and Obstetrics, 1915, xx, 715.

Knee-joint wounds must be drained thoroughly, posteriorly as well as laterally. Metal tubes are better than rubber. Then the patient should be placed in a bath. Antiseptics are not necessary. For a frequent dressing, Moynihan recommends Wright's hypertonic salt solution.

Then Sir Berkeley speaks of the observation of 1300 cases of frost-bite. When these patients reach the base hospital, experience has shown that it is best to leave the entire thing to nature; do not amputate; do not operate in any way; keep the parts warm and the patient comfortable; if possible, best, without any dressing.

George W. Crile[1] is naturally interested in the problem of shock, and his contribution to this symposium on military surgery is entitled: The Vivisection of a Nation. He discusses especially the effect of the German invasion on the Belgian people.

He is of the opinion that there will be a great deal of neurasthenia, insanity, permanent loss of efficiency from the destruction of a great number of brain cells, and in a number of cases local injuries in the brain due to actual rupture of bloodvessels. In this group of individuals there will be no wounds and probably no local trauma.

Crile[2] gives a second contribution on military surgery based upon his observations while in Paris with the Lakeside Unit of the American Ambulance Hospital.

They found that nitrous-oxide-oxygen anesthesia proved to be an ideal anesthetic for the minor operations, and in some cases for the dressing of the wound. Of course, it has not been universally employed because of its additional expense.

I am informed that Joseph A. Blake, in his service at this hospital, uses ether. Every wounded soldier on admission to Blake's service is taken immediately to the operating room, and the wound is examined. If there are any signs of infection, the patient is anesthetized with ether, the wound is thoroughly opened, foreign bodies removed; separate incisions made for gravity drainage, if necessary. It would appear to me that in operations of this kind nitrous-oxide-oxygen anesthesia might be better than ether. Crile was fortunate in having a supply of this anesthetic.

Crile, as all the others in this symposium, expresses the opinion that first-aid measures have failed and antisepsis has failed. Crile attributes this to the richness of the cultivated soil in France and Belgium which seems to be laden with different types of anaërobic bacteria. In addition, the soldier in the trench cannot keep clean, and perhaps—to my mind of the greatest importance—the common wound has become the shrapnel or shell wound, and not the rifle wound. In spite of the rich soil and trench fighting, rifle wounds, according to the statements of all of these observers, are rarely infected.

[1] Surgery, Gynecology and Obstetrics, 1915, xx, 708.
[2] Annals of Surgery, 1915, lxii, 1.

Crile writes that in spite of extensive researches and experience, no material progress has been made in the discovery of an efficient antiseptic, vaccine, or serum. The only serum which has been helpful is the antitoxin for tetanus, and this has been, and must be, given immediately after the injury before the signs of tetanus appear. Tetanus common in the beginning of this war has practically been eliminated by sending to the firing line the antitoxin to be employed as a first-aid measure.

In this war probably for the first time the research laboratory has gone to the front. Carrel's laboratory and hospital near the firing line is one of the best examples.

Crile mentions the consensus of opinion against dry dressings, and in favor of hypertonic moist dressings, frequently changed or the immersion of the wound or the patient in the bath. After the wound is granulating in a healthy way, the open-air treatment seems to give better results than a dressing of any kind. De Bouchet recommends the exposure of the infected wound to electric light. Crile states that in gas gangrene, Weinberg of the Pasteur Institute associated with Jablons, Pathologist to the American Ambulance, have apparently found a serum, but their researches are not yet published.

GERMAN VIEWS. On April 1, 1915, there was a Congress of Military Surgeons in Brussels, practically a substitute for the Congress of the German Surgical Society usually held in Berlin. Twelve hundred surgeons were present, and there was a symposium on military surgery.[1]

Hemorrhage. Garré discussed the treatment of hemorrhage in the field and later. I am surprised at his quoted statement that one of the most important tasks of the field surgeon is the checking of hemorrhage. Garré recommends the most accurate method—the clamping of bleeding vessels, leaving the clamps in place. He also mentions the use of intravenous infusion for loss of blood.

Tetanus. Kuemmel gives the following figures as to the occurrence of tetanus: Crimean war, 1.5 per cent.; American Civil War, 2.5 per cent.; Franco-Prussian War, 3.5 per cent.; present war, 6.5 per cent. Kuemmel, like Crile, attributes it to the richness of the French soil. The best treatment is the prophylactic dose of the antitoxin. When the symptoms of tetanus have developed, Kuemmel is of the opinion that magnesium sulphate is of the greatest value.

Gas Phlegmon. Kuemmel discussed this serious infection. If it is suspected, the wound should be examined every two hours for emphysema. The moment this sign appears, the wound should be freely opened.

Early Wound Treatment. Garré's observations agree with those of the Allies' surgeons. The wounds of rifle balls are rarely infected. The larger wounds of the grenade are usually infected. Garré is of the

opinion that these large wounds should be explored and cleaned out with the gloved hand in the field hospital. Apparently this view was not accepted by many other German surgeons.

Here we have, therefore, another voice favoring earlier intervention in these primarily infected shell wounds.

Payr and Goldammer discuss the treatment of wounds of the extremities, but I cannot get much out of the review. They advise free incision with the removal of foreign bodies, but the time and place of this intervention is not mentioned. Then the reviewer remarks that in spite of this intervention infection usually follows. Then it is stated that a firm dressing is contra-indicated, followed by the remark that plaster casts were of value. Immobilization is of the greatest importance.

Of course, that may not be the fault of the report from Brussels, because we find that no matter from what source we are getting information there seems to be the greatest difference of opinion in regard to the different problems. We must also remember that the different surgeons observe the wounded at different periods after the infliction of the wound, that very few know anything about the first-aid measures; they may not have estimated the presence or absence of first-aid immobilization and the character of transportation. In present-day war-methods the wounded pass like a foot-ball from hand to hand until they reach the base hospital. This probably explains much of the great difference of opinion.

Skull Injuries. Tilmann called attention to the great variety of wounds of the skull and the variety of symptoms. Penetrating wounds usually caused death very early; glancing wounds, laceration of the tissues by concussion. Early operations can consist only of the removal of fragments of bone and checking of external hemorrhage; later operations can be performed for meningitis and abscess. The reviewer does not mention decompression for hemorrhage. I had gathered the impression that early operation for compression due to hemorrhage had been very successful in this war, but I have been unable to find much in recent literature to confirm this.

Penetrating Abdominal Wounds. Here there is evidently considerable difference of opinion. Schmieden emphatically states that the expectant treatment is all right in theory, but is not possible in practice in time of war, as it is impossible to give these patients absolute rest. He advised operation in every case if the wounded soldier could be gotten into hands of a skilled surgeon within twelve hours. I have been unable to find any other German authorities advocating this procedure in the discussion.

This review of the Congress of the German military surgeons in Brussels is contained in a letter from Berlin dated April 20, 1915. It is unfortunate that we could not have these discussions in greater detail, and, so far, we have been unable to find the official report of this meeting

in any of the German journals. However, there is a number of contributions on military surgery in the recent German journals, in fact one gets the impression that all the German surgeons are concentrating their attention on the problems of war surgery only. I am led to this statement from the remarks of the Swiss surgeon, Kocher.[1] In thirty pages, according to the review, Kocher sketches the whole organization and working of the care of the wounded and sick in Germany. He remarks: "Against the dark background of the war there stands out in bright relief the care of the wounded on a scale beyond anything ever experienced or anticipated."

Kocher states that the great school of surgery today is in the military hospitals. Such an opportunity has never been offered before to study the principles of surgery. He advises all his colleagues in Switzerland to visit these hopsitals as observers.

He also calls attention to the fact that the German Army Medical Service and all the leading surgeons, internists and laboratory investigators are keeping in touch one with the other in the investigation of the problems, and they are trying in every way to make use of this huge experience. These surgeons are attending their usual annual meetings, and they are keeping each other posted on their experiences.

FRENCH VIEWS. We have already discussed what Alexis Carrel and Tuffier had to say about January, 1915. In the most recent number of *Surgery, Gynecology and Obstetrics*,[2] Prof. Theodore Tuffier gives us a second report of a general nature. In the first place, he had been consulting surgeon along the firing line from Belgium to Epinal. Most of his time was spent in the first-aid hospitals at the front. From his experience he briefly reviews what the medical corps must do. In the first zone—on the firing line—save lives, in the second zone save limbs, in the third zone—base hospitals—do reparative operations, chiefly infections and compound fractures. Tuffier is agreed with the German and English consultants that it is necessary to have some of the most experienced surgeons at the front.

The system which the French have developed up-to-date is apparently as follows:

In each sanitary group there is one consultant surgeon who tries to see all the seriously wounded and indicates whether operation is proper or not. Tuffier points out that during the early weeks of the war there were too many amputations, and these were not made at the base hospitals. Then there is the operating surgeon; often an experienced one may properly care for over one hundred wounded a day. Crile and Cushing, on their return from France, voiced the opinion of Blake and others of the American Ambulance in Paris that the quality

[1] Review: Journal of American Medical Association, 1915, lxiv, 1881.
[2] September, 1915, xxi, 278.

most needed in military surgery was judgment. Tuffier writes that to carry out an operation correctly needs but a few months' study, but to decide on the indications for operation requires a long surgical experience.

I trust we will appreciate this view in this country. Improvement, Tuffier states, though simple, was very difficult to bring about, but it has been accomplished, and the better results demonstrate the importance of the change.

Apparently, transportation of the wounded is, in some instances, more difficult than the treatment of infections. I got the impression from Cushing's and Crile's remarks that first aid had failed, because it could not be applied. It would appear as if in this war we will be unable to decide as to the protective value of first aid, because, in the great majority of cases, it had not been rendered. Tuffier states that transportation was not only defective in the beginning of the war, but it was more difficult, because the allied armies were retreating.

At the present time Tuffier divides the improved transportation into two parts: (1) the moment the man is injured until he is put on a stretcher; (2) from the time he gets on a stretcher until he enters the hospital.

Both Cushing and Crile called attention to the importance of uniformity in all stretchers. The wounded should be placed on the stretcher and that should be his bed until he gets to the hospital.

In the first period it seems difficult to get any improvement. During the day it is often impossible to get at the wounded. The majority of trenches are too narrow for the stretcher. The wounded must be carried out in the arms of a comrade or on a chair. The distance is often from 100 to 800 meters. This is the most painful part of the transportation. Tuffier says nothing about first aid, but states that in the beginning of the second part, when the wounded is put on the stretcher, "he is dressed with an individual dressing." At the first dressing station the wounds may be dressed again, and then the wounded is placed in an ambulance. From here he is transported to a hospital or railway. The more severely injured and those needing immediate operative attention are taken by ambulance to hospitals near the firing line. The other group travel comfortably by train to the interior of France.

When Tuffier considers wounds themselves, he calls attention, as all military surgeons now do, to the greater frequency of shell wounds and to the fact that it is impossible in many cases to distinguish the wounds of the present rifle bullet from the dumdum.

The shell wound is more dangerous, not so much because it is a larger wound, but because it carries into the wound infected foreign material in addition to the shell. The shell wound rarely perforates; bullet wounds, on the other hand, usually perforate and rarely carry with them foreign material. Here Tuffier suggests the immediate exploration

of shell wounds and the removal of foreign bodies. He has given this advice to the surgeons at the front.

According to Tuffier, the chief cause of death on the firing line are wounds of the skull and upper and middle thorax; then abdominal wounds. For this reason the majority of wounds which reach the division and base hospitals are those of extremities, chiefly compound fractures, usually infected. Tuffier states that now, as a result of trench fighting, these wounds are practically all infected, while during the first few months of the war, before the men were in trenches, infections were less frequent. Tuffier voices the opinion of all that the chief problem is the treatment of infected wounds, and that since the beginning of the war no progress has been made.

The greatest difference of opinion prevails as to asepsis and antisepsis; almost every surgeon has his favorite antiseptic. Serotherapy, except in tetanus, has failed.

Tuffier makes a very important statement: "I have met surgeons in a number of ambulances and hospitals, each of whom boasted of his product (antiseptic), but on looking into the matter closely I have always found that their success was due to the *extremely attentive care* they gave to the wounded, rather than to the product they used."

Every surgeon, especially the younger ones, should remember this statement. The history of the treatment of suppurating wounds proves the necessity of frequent dressings and conscientious, intelligent attention to details. As I have stated before, the modern surgeon has little experience with infected wounds. The dressings of suppurating wounds are often delegated to the least experienced member of the group. There is no new antiseptic as yet; there is no serum. Wright's lymph lavage means constant dressing and great attention to the wound. It is a question in my mind whether the hypotonic salt solution is essential in the continuous irrigation.

Tuffier[1] a few months before had spoken in favor of antisepsis over asepsis. In this article we search in vain for the previous statement. He writes: "Despairing of finding a chemical antiseptic, we have returned to physical antisepsis—*hot air and heliotherapy without dressing.* However, he repeats his former statement as to the necessity of drainage on the principle of Cassaignac. As Godlee, the English surgeon, remarks: "Back to Lister!" so Tuffier cries: "Back to Cassaignac!" We can therefore read in Tuffier's paper these essential principles; drainage of all infected wounds, immobilization of all fractures; special treatment

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[1] After an experience of eight months' war surgery he wrote: "I desire to do honor to the teachings of two great French surgeons Chassaignac and Lucus-Championnière, because this war experience so far has demonstrated the *superiority of antisepsis over asepsis*, and the drainage of infected wounds at the most dependent angle." Journal of American Medical Association, 1915, lxiv, 832.

of gangrenous wounds, which will be discussed separately under different headings.

AMERICAN VIEW. It is interesting to read the contribution of Col. Louis A. LaGarde.[1] We must remember that LaGarde was the first to prove experimentally that all bullet wounds were primarily infected. He has given us the best book in English on gun-shot injuries.[2]

LaGarde writes that the nature of the infection in a gun-shot wound is not different from that in other wounds, but the result of such infection is largely due to contributing factors. He then describes a compound fracture in civil life. Here the injury to the soft parts as a rule is confined to the vicinity of the fractured bone; the bone as a rule is not comminuted; the patient reaches a modern hospital quickly and receives prompt and proper attention; infection rarely results; if it does, it is superficial and retards the healing but slightly. In a gun-shot wound, the injury to the soft parts is much more extensive; the bone is broken into many fragments; there are often foreign bodies; in addition, the vitality of the tissues in the region of the wound may be impaired by molecular concussion; foreign particles are driven in all directions. The wounded soldier cannot receive the proper immediate attention, and, by the time he gets to a hospital where proper treatment can be administered, infection is well established. I have quoted Watson Cheyne in the statement that the difference in infection of gun-shot and shell wounds from wounds in civil practice is only one of degree.

GUN-SHOT WOUNDS. *Historical.* Meltzer, in his presidential address before the last meeting of the American Physicians, most wisely remarked that a number of well-established truths of older medicine were being forgotten. I am repeatedly observing that the younger surgeons are absolutely ignorant of, or but slightly familiar with, a number of surgical principles and treatments which were well established and well known to the older group of surgeons.

The younger group know little of the treatment of infected wounds. This is due to the fact that operative wounds rarely suppurate and accidental wounds are treated so quickly that infection is rare.

In reading the contributions of many surgeons about their observations and experiences of the present war, one cannot help but conclude that many of them, especially the younger group, should have spent some time in the library before they went to the front to treat the wounded.

For this reason I am reading with a great deal of interest Riedel's[3] recent contribution, in which he compares the views on gun-shot wounds from 1870 up to the present time.

Before the Franco-Prussian War, in 1870, von Langenbeck was

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[1] Surgery, Gynecology and Obstetrics, 1915, xxi, 241, abstract.
[2] William Wood & Co., 1914.
[3] Deutsche Zeitschr. f. Chir., 1915, cxxxiii, 113.

practically the only German surgeon who advised against interference in bullet wounds. He then urged there must be no probing, no examination of the wound with the finger. It is dangerous, he writes, to dislodge the protective blood clot; it allows the entrance of air and may excite fresh hemorrhage.

In addition, at that time von Langenbeck emphasized the importance of immobilization, especially of wounds of the knee-joint, an advice which the great surgeon Larray had given before.

Lister, then little known, made an important contribution to the *British Medical Journal* for September 3, 1870, which was translated and appeared in the *Berliner klinische Wochenschrift*, 1870, No. 9. Although English surgeons at that time had had little experience with gun-shot wounds, Lister must have been influenced by his wonderful results in compound fractures, and felt that he had a mission to perform in giving advice to the surgeons who were to treat the French and German wounded.

Lister advised that in every gun-shot wound the canal should be filled with a 5 per cent. solution of carbolic acid; this treatment should be administered as quickly as possible; after this solution had been introduced into the wound, attempts should be made with great gentleness to extract the larger and easily accessible foreign bodies and fragments of bone; accessible bleeding vessels should be ligated with antiseptic catgut, and the wound should be dressed with a material saturated with carbolic oil 1 to 5.

As Riedel writes, unfortunately this advice was not followed.

In 1870, the majority of surgeons viewed suppuration of a wound as laudable and physiological. The chief treatment of a gun-shot wound at that time was repeated examinations of the wound by the finger of the surgeon, usually more uncleanly than at home, because, as von Esmarch wrote in 1876, there was neither soap nor water with which to clean the hands.

We trust Riedel exaggerates, because he states that the wound was repeatedly examined by the surgeon, and when there were visiting surgeons to the hospital they were invited to put their fingers into the wounds. Apparently, only Fischer and Socin heard the voice of Lister.

John Ashhurst, in the 1889 edition of his *Surgery* (page 173) writes: "The finger constitutes the best probe for all parts within its reach."

As, in 1870, all surgeons viewed suppuration as the natural consequence of the wound, of course, they would be unable to see any harm in this exploration with the dirty finger. Yet it was known at that time that some bullet wounds did heal without suppuration and that encysted bullets gave rise to no trouble. Apparently, however, these less frequent observations did not excite sufficient curiosity.

We must recollect also that at this time, although Riedel does not state it, Lister thought infection of the wound came from the air. It

was Lister's opinion that every gunshot wound was primarily infected, not because of the foreign body and dirt carried in by the bullet, but because air could enter.

We must also observe that von Langenbeck's objection to the examination of wounds was not because of the dirty finger, but Lister's view. Surgeons at that time did not know that their fingers were dirty.

Von Langenbeck read his paper on gun-shot wounds before the Friedrich-Wilhelm Institut and published it in pamphlet form, but not in his famous Archives. In this paper, non-interference, antiseptic dressings and immediate mobilization with plaster are recommended, but for some reason or other this important contribution of a then great German surgical authority had little influence. In this paper he reported 18 gun-shot wounds of the knee-joint, with 14 recoveries—results as marvelous as Lister's in compound fracture.

When Socin attempted to follow Lister's method, he failed because before he had an opportunity to treat the wounds, the dirty finger had produced conditions which his method of using carbolic acid could not combat.

Riedel criticizes Billroth soundly, but perhaps not justly. It is true that Billroth was a student of Langenbeck, but at this time no longer under his tutelage, and probably Billroth had not known of Lagenbeck's contribution.

Riedel shows, however, that Billroth had a great opportunity, and, from what we know of Billroth, it must have been one of the few opportunities he failed to grasp.

After the battle of Weissenburg, Billroth did not see the wounded until after forty-eight hours had elapsed. Apparently, for some reason, most of them had escaped the dirty finger. Few, if any, of them had a diagnostic tag, and we know from Riedel that the diagnostic tag ordered an examination with the finger.

Billroth wrote that all of these wounds looked as if freshly made; only in some of the more severe compound fractures was there any swelling.

Riedel here remarks: Unfortunately, Billroth was not then ordered to the front, but was left to satisfy his curiosity with the dirty finger. Had Billroth and his associates been ordered away and less experienced physicians left with the wounded, they might have been more timid, and then on Billroth's return three or four weeks later, he would undoubtedly have recognized the importance of non-interference, and he would have been the man to have made this conservative treatment the rule.

Ambrose Paré (1510–1590) had better luck than Billroth. His material for treating wounds gave out, and, to his surprise and joy, the patients whom he could not treat did better than those treated. From this

experience he immediately formulated a view that gun-shot wounds are not necessarily "poisoned," and that cleanliness and support often suffice for their cure.

Mumford mentions this in his historical sketch.[1]

German surgeons knew of Lister's methods, but they could not get results with this method after the examination of the wound with the dirty finger. Lister and von Langenbeck never advised to make the examination with the finger.

It was some years before surgeons appreciated the chief cause of the infection of gunshot wounds in the war of 1870. In fact, it was not until 1894–1895 that surgeons really attributed most all suppurations of clean wounds to their own hands. This finally led to the introduction of rubber gloves.

Riedel's article gives a very interesting description of the vacillations in wound treatment. First, after 1870 Lister's method won out, but many of the suppurations due to infected catgut were attributed to Lister's method. Then, about 1880, iodoform and iodoformized gauze, then bichloride of mercury, came in. It was this antiseptic that predominated in the Johns Hopkins, in the clinic of Dr. Halsted in 1890.

The more perfect sterilization of catgut in 1900, which, however, had been preceded by the more perfect preparation by boiling and later the introduction of rubber gloves rendered antiseptic methods almost unnecessary for clean surgery. Then iodine came in the disinfection of the field of operation, and alcohol for the hands of the surgeon.

Von Bergmann, after the war of 1870, formulated his rule of non-interference, and forbade the examination with the finger or probe.

This historical review by Riedel comes at a very opportune time. It brings out in strong and convincing language the mistakes of the past, and also that frequently good advice has not been followed at the right time.

The impression I get from this and other reading is that we were not at all prepared for the results in this war. The surgeons are clean, and there are no dirty fingers; there are good operators at the front, and often the very best environment for good surgery, but we are only beginning to appreciate that the equivalent of a dirty finger has been in the wound before the aseptic surgeon sees it, that dirt has been introduced by the shell or grenade and was on the soldier's clothes and skin because of trench life, or the almost unsurmountable obstacles to cleanliness in warfare on land.

The little evidence so far at hand, as mentioned before, seems to show that the same shell wounds in sailors do not suppurate.

Apparently, therefore, every surgeon must look upon every shell wound as infected from the moment it is inflicted, and that the sooner

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[1] Keen's Surgery, 1906, i, 34.

such a wound is freely opened the better. The only difference of opinion is whether an antiseptic should be employed or not. Personally, I am rather inclined to feel that Lister's advice, given in 1868, still holds good —the wound should be disinfected.

I discussed in these December numbers of PROGRESSIVE MEDICINE, some years ago, von Reyherr's splendid contributions. He was one of the first German surgeons to disagree with von Bergmann's teaching that primary infections of gun-shot wounds was rare, and von Reyherr, from his experience in the Russo-Japanese war, was of the opinion that some shell wounds should be opened at once and disinfected, especially those in the region of the thigh and buttocks.

FIRST AID. *Activities of the Surgeon on the Firing Line.* L. Rehn[1] the consultant surgeon, is of the opinion that sterile gauze is sufficient; that it is unnecessary to use any disinfectant at this first dressing. As a rule, the soldier puts on his first-aid dressing pretty well.

The so-called troop, or regimental, surgeon and members of the stretcher-ambulance corps are on duty behind the firing line, but Rehn says there is an opportunity here for the consulting surgeon. In the first place, his experience has demonstrated that the Esmarch bandage, or any form of constricting band applied for hemorrhage from the extremities, has done more harm than good when applied by soldiers or ambulance-corps men on the firing line. It is for the surgeon to decide whether the Esmarch should be applied or not. Rehn remarks that it is much better, if possible, to catch the bleeding vessel with a clamp and leave further treatment of the hemorrhage to the first dressing station.

All our manuals on first-aid give a great deal of space to the checking of hemorrhage and the employment of the Esmarch, in spite of the fact that many surgeons of experience have felt this was dangerous knowledge to impart to a layman. Rehn again emphasizes this danger. When the new first-aid manuals are written, the part in regard to the Esmarch and the treatment of hemorrhage should be rewritten. As a matter of fact, hemorrhage of a type that can be helped is rather rare, and there is very little opportunity on the firing line to do very much. The problem is a purely surgical one. These wounded should be left alone by their comrades and non-professional members of the stretcher corps.

TEN COMMANDMENTS FOR MILITARY SURGEONS. Von Eiselsberg,[2] of Vienna, has formulated the following ten rules:

1. Don't touch the fresh wound, but cover it at once with a piece of sterile gauze in the first-aid dressing. Do not employ any antiseptic or irrigation. Fix with a bandage, but not sufficiently tight to cause

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[1] Beitr. z. Klin. Chir., 1915, xcvi, 116.
[2] Surgery, Gynecology and Obstetrics, 1915, xx, 717.

constriction. In some cases a piece of adhesive strap will prevent the bandage from slipping down on the extremity.

Von Eiselsberg mentions, in this rule, the possible employment of mastisol to hold the piece of sterile gauze (see PROGRESSIVE MEDICINE, December, 1914, p. 199). Rehn objects to mastisol, or even too much adhesive plaster, anything which inhibits free drainage.

2. Von Eiselsberg's statement in regard to hemorrhage is that when local compression is insufficient, the tourniquet should be employed. Any attempt at controlling the hemorrhage with instruments or ligation should be deferred to the first dressing station. Apparently this advice is for the regimental surgeon on the firing line. Yet, Rehn seems to express the opinion that the clamping of the bleeding vessel should be performed, if possible, at once. This difference of opinion among high authorities seems to show that they have not had much actual experience with the treatment of hemorrhage on the firing line. The regimental surgeon apparently does not write about his experience, and, as the wounded pass rapidly from his observation, he is unable to judge of the results of the different methods.

It is my opinion that at the present time we should follow the advice of Rehn, based upon his observation that more harm than good has been accomplished by the application of the Esmarch on the firing line.

3. The bullet wound should not be probed or examined in any way. This is practically the advice in the first commandment.

It will be discussed later, under the heading First Dressing Stations, whether it is not a good plan at this place to examine the large shell wounds with the gloved hand and remove foreign bodies with a sterile instrument—a procedure for the experienced surgeon only.

4. Fracture should be immobilized, but it is not important in the first immobilization to attempt any accurate coaptation of the fragments. All that is necessary is sufficient immobilization to prevent the splintered bone from producing further injury to the soft parts and vessels.

Then von Eiselsberg writes that the fixation may be accomplished by means of plaster, if the material is at hand and the physician is a master of the technic, but in general, splints are best, and of all splints, a wire splint answers the purpose. The most difficult fracture to fix is that of the femur.

It would seem that on the firing line no attempt should be made to employ splints. Fractures of the upper extremity can be well treated by resting the flexed extremity against the chest and holding it with a sling made from the coat of the soldier, or the Esmarch handkerchief-bandage. Soldiers with fracture of the lower extremity should be placed on a stretcher, the injured limb extended and fixed with a loose bandage to the opposite limb. Further treatment should be left for the first dressing station.

The remaining six of the ten commandments have to do with measures which, however, are not employed on the firing line.

Payr,[1] from his experience with the German army in the North of France, emphasizes the importance of the surgeon's work in first aid. Hemorrhage must be stopped, further infection prevented, immobilization properly improvised, and transportation supervised to the most minute details.

Ligation of bleeding arteries, if there is proper equipment, can be performed in the first-aid station. Sterile gauze is sufficient for the first-aid packing. This is often well applied by the soldiers themselves. Improvised splints can be made from the limbs of trees and padded with straw or grass after the wound is properly protected with sterile first-aid dressing. No attempt should be made to probe for, or remove, the bullet. The surgeon at the first-aid station should prepare the wounded soldier so that he can be transported without further accidents. Payr does not mention antiseptics at all.

He calls attention to the frequent presence of foreign bodies in the shrapnel wounds and that at least 75 per cent. of these cases suppurate, but he does not discuss whether these wounds should be operated on in this earlier period.

Chevasse,[2] Chief of the Medical Department of the French Army, in his manual of instruction written in November, advocates tincture of iodine, of 1 per cent. strength, in the treatment of all recent wounds. Wounds should never be completely closed. Constricting bands or tourniquets are advised against. In larger ragged wounds, foreign bodies should be removed, and the entire wound washed out with hydrogen dioxide or pure oxygen, followed by the application of tincture of iodine.

Delorme,[3] Medical Inspector of the French Army, has written a manual entitled Advice to Surgeons. Apparently this was gotten up after a short experience in the recent war, before trench fighting began. His rule was: leave the wound alone and it will heal; don't remove fragments of fractures or foreign bodies. Undoubtedly, Delorme was giving advice for bullet wounds. Hartmann, a civil surgeon, after four months' experience, calls attention to the frequency of shell wounds and their later suppuration, and for this reason early opening of the wound, for the removal of foreign bodies and fragments of bone and for disinfection and drainage, is indicated; conservative treatment can no longer be followed in wounds of this type.

We can no longer depend upon the simple aseptic dressing or the tincture of iodine, except in the simple bullet wounds which are becom-

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[1] Journal of American Medical Association, 1914, lxiii, 2242.

[2] Bul. de l'Acad. de Med., November 24, 1914; review in Journal of American Medical Association, 1915, lxiv, 278.

[3] Paris, Masson et Cie, 1914, reviewed in Surgery, Gynecology and Obstetrics, 1915, xx, 378, abstr.; and Journal of American Medical Association, 1915, lxiv, 757.

ing rare in this war. Hartmann uses, for irrigation, hydrogen peroxide or a carbolic solution.

Although I am discussing this under First Aid, this procedure will probably have to be done at the first dressing station, or the division hospital. The sooner it is done the better, but the probabilities are that it will be impossible to create conditions under which it can be done before the patient reaches the first dressing station or the division hospital.

Makkas,[1] from his experience with the Grecian army, does not think much of the first-aid package. Few soldiers use it, and he is also of the opinion that all infections are primarily due to dirt and foreign bodies carried in by shell.

In a previous report from the Grecian army, this statement of Makkas was controverted. The first-aid package was employed by the soldiers, as a rule, and well put on in spite of the fact that the directions were in French.

A. W. Meyer,[2] from his experience in the Bulgarian war, where he had opportunities for observation at the front as well as the base hospitals, agrees with von Reyherr that the majority of infections are primary and are carried in by foreign bodies, especially the clothing. He also expresses the opinion that the first-aid package is not of any great value. Both the German and Russian package are too small to prevent secondary infection. He is of the opinion that every soldier should have two packages of dressings which should be larger.

He also points out that the application of splints for fracture is faulty. Surgeons must be better instructed.

Many injuries can be properly fixed on the stretcher.

Von Rothe[3] writes on first-aid, not from the actual experience on the firing line, but from the results which he has observed at the division or base hospital. It is his opinion that first-aid is very important and that at this first dressing everything should be done that can be done. Yet it seems to me that what this German surgeon wants to be done can rarely be accomplished, except at the first dressing station, and it is quite possible that that is what he means.

For example, he is of the opinion that the wound should be covered with a piece of sterile gauze, then the skin about it cleansed. We know that the soldier's skin is unusually dirty, and, when wounded, covered with blood. Von Rothe says iodine can be of no value until the skin is cleaned. He does not say how the skin should be cleaned. The probabilities are that material, such as alcohol or benzene, would not

[1] Deutsche Med. Wchnschr., 1914, xl, 231; reviewed in Surgery, Gynecology and Obstetrics, 1914, xix, 274, abstr.

[2] Arch. f. klin. Chir., 1914, ciii, 798; reviewed in Surgery, Gynecology and Obstetrics, 1914, xix, 274, abstr.

[3] Beitr. z. klin. Chir., 1915, xcvi, 181.

be available at the first dressing station for this. In larger wounds he even advises that the skin should be shaved. I am confident that if the skin is to be cleaned in this way it must be done by a surgeon, and it can only be done by him at the first dressing station.

It is also the opinion of this German surgeon that fractures should be immobilized with plaster. I get the impression from my reading that he expresses the minority opinion.

When the wound must be packed and compressed because of hemorrhage, it should be covered with a red cloth, or some distinctive mark which will indicate that the dressing should be changed and compression relieved within a few hours.

Of all of the German authorities which I have read, this is the first one to emphasize the cleansing of the skin and the employment of plaster as first-aid measures. He does not discuss whether it is possible for this to be done.

F. Goldammer,[1] in his War-surgical Experiences from the Greco-Turkish and Greco-Bulgarian Wars of 1912–1913, writes: "While, therefore, I would have every operative treatment of fresh firearm injuries banished from the dressing stations, I yet insist that, especially on the foremost stations of the medical field of activity, should be placed good surgeons—not that they may operate there, but, on the contrary, in order that, by following strict and exact indications, unnecessary operations may be avoided and, principally, that good dressings may be provided. For it is faultless dressing work that, as indicated by the name dressing station, should be done there. The work should be done *rapidly* and *thoroughly*, and the personnel and material should be adapted for this. I do not wish to touch here on the question of first-aid packages, the more so, since for the lack of personal experience I am unable to take position toward the much discussed mastisol dressing. What I have learned, however, is that one gets along very well even without mastisol. In the Greek army no adhesive dressings were included in the first-aid package, which, however, has sufficed everywhere, notwithstanding the fact that the French model employed was not very practical, as it was sewed in twice and the men were not sufficiently instructed in its employment; the imprinted French directions, of course, could be read and understood only by a very few."

No operation on the firing line; amputation, tracheotomy, hemostasis, drainage of the urinary bladder are rarely, if ever, indicated.

Wounded often are unattended for hours before first aid.

The employment of the Esmarch for hemorrhage is more apt to do harm than good.

Plaster dressings are of no value on the firing line.

Local anesthesia is of no value on the firing line.

[1] Beitr. z. klin. Chir., 1914, xci, 14.

If possible, ether in small vials (30 c.c.) and morphine hypodermically, would be best.

The majority of injured are shocked, and this is due chiefly to pain and psychic disturbances. What they need most is rest, heat and morphine for pain; next to these factors, the general condition of the patient should receive attention, and third the injury.

The shock is in proportion to the extent of the superficial trauma.

He advises digalen, and in some cases strychnine, and, in desperate cases, adrenalin-salt intravenous infusion.

One must distinguish shock from perforation of abdominal viscera.

Hot tea and hot soup are better than alcohol.

Except in skull-brain injuries the wound of exit is larger than of that of entrance. Pain is always present in wounds of exit, infection also more frequent there.

Von Bergmann was wrong when he said that there is no primary infection in bullet wounds (all infections are secondary) but right when he said: Bullet wounds heal uniformly well if treated properly at once. The first bandage settles the fate of the wounded. Col. LaGarde comments on this: "We can cite many instances in which first dressing did not, nor could not, influence virulent infections carried in with the projectile, clothing, and dirty skin."

In all wounds the essentials are fixation, dry dressing, rest, immobilization of the part, no transportation, if possible; good transportation, if necessary.

The wounded must be tagged to prevent too frequent dressings. It is questionable whether iodine is of any value. Repeated application of iodine does harm.

With good fixation and proper transportation, infections of fractures fell from 42 per cent. to 29 per cent.

Observations on infections of wounds vary at different distances from the firing line. Those healing primarily, as a rule, reach the base hospitals, the infected cases are retained for treatment at intervening stations.

The infections do best with conservative treatment.

Boric acid powder is recommended for pyocyaneus infection. Intravenous electrargol for general sepsis.

Col. LaGarde comments on the above as follows: "In a well-appointed hospital if the x-ray and other evidence point to much displacement of fragments, the loose spicules should be removed by enlarging the wound of exit and a drain placed for thirty-six hours. Otherwise, long-continued separation and discharge of dead bone will occur. In such cases it is better to be too aggressive than overconservative. No harm can result from exploration if the surgeon is controlling environments."

When Fraenkel[1] compares the experience in the Servo-Bulgarian War

[1] Beitr. z. klin. Chir., 1913, xci, 1.

of 1885 with the recent Balkan wars, he says he has learned nothing, except what he should have known before. The majority of wounds, if left alone, heal. Lister's maxim of non-interference still holds good. He forgot to give reference to Paré, before Lister, who promulgated the rule of non-interference, to be forgotten again.

Fraenkel is also of the opinion that there is really little difference between the effect of the old and the modern bullet. Surgeons see more aneurysms now, because in the older wars the wounds were probed, and for this reason vessel injuries died of infection or secondary hemorrhage, or were amputated, so that these increased numbers of traumatic aneurysms simply indicate better healing of the primary wound.

Pirogoff rarely saw an aneurysm.

PRIMARY AND SECONDARY INFECTION. Stromeyer, an old military surgeon, was of the opinion that all bullet wounds were primarily infected, while Simon, in 1851, from his experiments, proved that bullet wounds healed primarily, that is, if there was any infection, it was taken care of.

Pirogoff, from his observations, also recognized the principle of non-interference and fixation dressings with plaster.

Primary infection is usually associated, both in war and peace, with firearm injuries at close range, and where foreign substances are carried in with the bullet. In these injuries tetanus and gas bacillus infections are more frequent.

Another article,[1] which he does not mention, calls attention to the frequency of gas bacillus infection in injuries of, or about, the buttocks.

Whether bacteria enter with the bullet or not, all authorities agree that in the great majority of cases these wounds heal if secondary infection is prevented.

Fraenkel is of the opinion that antisepsis in the primary dressing is of no particular value and that mastisol is of value only as an adhesive.

The principles of treatment, therefore, of most wounds are non-interference, occlusion dressing, immobilization of fracture and injured vessels.

No exception should be made in wounds of the chest.

In wounds of the abdomen, hemorrhage is the only indication for immediate operation.

In injuries of the skull, especially tangential, with or without depressed fractures and in all cases of compression, decompression operation should be done as soon as possible. Holbeck's statistics show a difference of 14 per cent. mortality in the cases operated on primarily, and 49.9 per cent. in secondary operations.

Yet Fraenkel reports four cases who remained on the firing line twenty-four hours, who were transported three days, and still recovered

[1] Von Reyher, PROGRESSIVE MEDICINE, December, 1910, p. 2011.

after decompression. My comment on this statement is that if these four patients could stand four days of this ordeal, they could also stand a decompression operation.

The conclusions reached by Kayser[1] from a series of experiments are as follows:

1. Destruction of germs adherent to the bullet by the explosion does not take place, and it is immaterial whether the germs are attached to the pointed or to the cylindrical portion of the projectile.

2. It is further of no importance whether the bullet has passed a shorter or longer track.

3. Notwithstanding perforation of resistances, the bullet remains infectious.

4. On the interposition of strong resistances, a destruction of the germs may apparently take place.

5. On passage through septic clothing material, there is always a transfer of germs capable of development, and even the introduction of strong resistances does not seem to be able to prevent this transfer.

6. When gelatin plates are shot at, there is always a scattering of the germs introduced, and foreign bodies thrown into it are always deposited in a wide circle around the bullet track.

7. On shooting at gelatin plates with non-infected bullets, only germs commonly found in the air develop.

MILITARY SURGICAL CONSULTANT. Sir Berkeley Moynihan, of the British Army, is known as a Field Consultant and has the rank of Lieutenant Colonel. His brief remarks on military surgery from the viewpoint of a field consultant have been discussed (page 232).

L. Rehn,[2] of the German Army Medical Corps, writes of his experience as consultant surgeon to the 18th army corps in France. This is a personal letter to the editor of the *Beiträge* written some time in November, 1914. His first experience was with the advancing army, the later experience with trench fighting. He expresses the opinion that the consulting surgeon is a very important innovation, and that his activity should be chiefly supervisory; that personal operative activities are of secondary importance. The presence of the consulting surgeon should by no means be confined to the base hospital, but with great activity and rapidity he should move on his tours of inspection from firing line to base hospital. He should not wait to be asked in consultation, but should force his superior knowledge and experience with the authority of his position and rank wherever it is required, and he should find out for himself where his services are most needed. In many instances, absolute explicit orders should be given, to be followed both in spirit and to the letter. In other cases suggestions are sufficient.

Of all the contributions that I have read so far, this one apparently

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[1] Beitr. z. klin. Chir., 1914, xcii, 199.   [2] Ibid., 1915, xcvi, 116.

covers the largest ground. Rehn remarks that there has never been a similar war, and everywhere there are new problems. It is not only the number of the wounded, but the character of the wound that makes the experience new and unusual. Shell wounds predominate; trench fighting has apparently increased the difficulties of first aid; the long range of the artillery fire has made rapid transportation from the firing line more difficult. Infected wounds are the rule. The treatment of the late stages of such infected wounds is most unsatisfactory.

The difficulties of the sanitary corps are apparently far greater than those of the line. The problems of moving troops, of feeding them, or protecting them from disease and of furnishing the firing line with ammunition seems much easier as compared with the treatment of the wounded and their disposition. Apparently, this is not due to failure of organization, but to the almost unsurmountable difficulties due to the huge numbers on the fighting lines, the great number of shell wounds, and the difficulty of preventing primary and secondary infection. It seems almost impossible to give these wounded the benefit of modern surgical methods at the proper time.

I will discuss Rehn's experience under different headings.

First Dressing Station. Rehn describes this in his letter. This station is in charge of the sanitary corps and should be placed in a protected spot as near the firing line as possible. It is indicated by a Red Cross flag by day and a red light at night. The wounded are brought to this station by the ambulance corps. Of course, this is a mobile sanitary outfit, but in trench warfare may be more or less stationary.

One surgeon takes charge of the wounded as they arrive and separates them into different groups. He reads the diagnostic tag, estimates the general condition of the patient and inspects the first dressing. A second surgeon handles the morphine, and all those in pain are relieved in this way as rapidly as possible.

In this station there is always an improvised operating-room and dressing-room; an improvised kitchen where water can be boiled, and hot soup, coffee or tea prepared. There is nothing permanent about the outfit.

Here it is possible to do certain operations and make certain immobilizing dressings which cannot be done on the firing line. Nevertheless, the surgery done here is of the simplest type.

According to Rehn, threatened asphyxia is first attended to, but these cases are rare, and it is not often necessary to perform tracheotomy. Then, all the cases of hemorrhage are inspected—the Esmarchs removed (in many instances these should not have been put on); the checking of hemorrhage is confined to the simplest procedures.

Abdominal wounds are inspected. Prolapsed intestines are returned, providing the intestine is uninjured; otherwise it is left out for a fecal fistula. Prolapsed liver and lung are left alone. As Rehn does not

believe in operation upon abdominal cases, no intestinal sutures are performed. His rule is to be conservative, and, as I will bring out later, many of his cases have recovered.

Next, chest wounds with open pneumothorax are examined, the opening in the pleural cavity closed by suture or pack. Rehn recommends immediate closure with continuous suture.

Retention of urine is not an infrequent condition in the wounded, even when there is no actual wound of the urethra or bladder. These soldiers must be relieved by catheter or suprapubic aspiration. When there is injury of the urethra or bladder, a permanent catheter must be introduced through the urethra when possible, or through the suprapubic route by puncture.

He says nothing about the treatment of shock, except the administration of morphine. Salt infusion and blood transfusion are not mentioned here. We must therefore conclude that these things are either not necessary, or are very difficult to perform at the first dressing station.

The emergencies having thus been attended to, all the dressings are inspected. The object of this inspection is to repair all defects and to redress others, so that in the next transportation these dressings will remain in place.

The chief work is the fixation of fractures. Rehn remarks that plaster takes too much time. He emphasizes the importance of inspecting all dressings to see that there is no constriction, on one hand, nor too loose dressings, on the other. This first dressing can accomplish but two objects—protect the wound from secondary infections, and fixation for rest. Rehn does not go into details, nor does he discuss the difficult problem of shell wounds.

I get the impression that here is the best place for the removal of the foreign bodies, for the application of some liquid ointment dressing, for the incisions necessary for drainage in the large shell wounds. There is never sufficient dressing on the firing line for these wounds—there should be at the first dressing station.

One will observe that really nothing is said of disinfection. The only emergency operations up to this time are tracheotomy, closure of pneumothorax, catheterization for retention, simple measures for hemorrhage, reduction of healthy prolapsed intestines.

Lloyd Miles,[1] of Los Angeles, describes his three months' experience in the Vienna General Hospital. He happened to be there when the war broke out and volunteered his services to Prof. Buedinger. There were 322 cases under his own observation; in addition to this, he was able to observe 1100 gun-shot wounds in other wards. The following is what he has to say about first aid, or first dressings: "Apparently

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[1] Journal of American Medical Association, 1915, lxiv, 1224.

all the writing of earlier wars has left no impression on the doctors at the front, for in the earlier days of the war many patients returned beautifully tamponed with gauze, or with pads of cotton next to the wound, and so dried and hardened by the secretion that they formed efficient plugs. Iodoform powder and tincture of iodine were also used, but, in common with cotton dressings, they coagulated the discharge of blood and serum, and patients often reached the general hospital with the skin distended almost to bursting with thick pus. Later practice became fairly well standardized and plain gauze dressings the rule."

TRANSPORTATION. *Automobile Surgical Hospital.* In the *Journal* letter[1] from Paris, dated May 6, there is described for the first time the automobile surgical hospital. The difficulty of performing any operation between the firing line and the base hospital is commented upon by all surgeons with any experience. Even with the best transportation there is often considerable delay in bringing the wounded to the base hospital, and best transportation is the exception rather than the rule. A large proportion of the wounded do not need this operative attention.

The automobile surgical ambulance really brings the operating-room and the surgeon of the base hospital to the wounded, so that the necessary operation can be performed under the proper environment as quickly as possible after the infliction of the wound.

This mobile operating-room equipment consists of nine automobiles of twenty horsepower each (Ford power). They are distributed as follows: Six serve to carry the supplies and the staff; one is the x-ray laboratory on tires; another carries the sterilizing outfit; the last the pharmacy.

This flying surgical hospital probably goes on call when the battle begins. The surgeon chooses the situation; each motor has its appointed place. Within one-half hour, which is more rapid technic than in a circus, the tents are pitched, containing an operating-room, with four tables, a preparation-room, and a dressing-room. The car with the sterilizing apparatus and the x-ray car back into position. The motor of the cars at rest furnish the electricity for lighting purposes. Sheets of aluminum act as floors. Nothing in the letter mentions where water is obtained, although it does say that everything is capable of being cleansed by having the water turned on.

In a letter written by Rehn, a German surgeon, which I have just read, he emphasizes the difficulty of getting water. There is no reason why there should not be a special motor to carry water.

In this flying surgical hospital, operations can be done under the same environment as at the base, or in a modern civil hospital.

[1] Journal American Medical Association, 1915, lxiv, 1861.

The corps consists of a chief surgeon and six assistants, twenty-five nurses, of whom ten are medical students, one pharmacist and one administrative officer—thirty-four individuals in all, or about six to a motor.

It is estimated that this unit can care for one hundred wounded during the day. Now, of course, the writer of this letter does not mean that there would be one hundred operations a day.

As yet I can find no definite report as to what these flying surgical hospitals have accomplished, but the first unit of this kind did not start to the front until May 5, and on the next day the information was sent to this country.

I mention this automobile ambulance, because it suggests a new form of transportation. The operating-room is taken to the injured rather than the injured to the operating-room. Undoubtedly, in operating-rooms of this kind operations can be performed earlier and wounds can be better fixed, so that the injured soldier can now be transported further to the rear with less discomfort and a better chance of recovery.

Evacuation of the Wounded (Ibid., p. 1863). The usual measures for the distribution of the wounded are described in the *Journal* in a letter from London, dated May 14. First, there is the firing line. Here the wounded are given first aid by themselves, comrades, or stretcher corps, and as soon as possible are borne to the rear on stretchers. In the transportation to the rear the first stop is at the regimental aid post called in this country first dressing station. This is in some sheltered spot, a fire is going, so that the injured can be given hot coffee, tea or soup. At this point the injured can be reinvestigated, redressed if necessary, given morphine, allowed to rest and be treated for shock, and perhaps a few minor operations can be performed here. Here also the wounded are sorted; some are returned to the front as their wounds are insignificant. Those whose wounds do not prevent them from walking, but whose character prevents further activity on the firing line, walk further to the rear. The more severely wounded, after receiving the necessary attention, are transported farther to the rear by stretcher or ambulance to what is called the divisional field hospital. This unit has tent space for about two hundred. The Germans call it the *Feldlazarett*. Rehn, in the letter which I have quoted, states that he was usually called upon to treat, in this hospital, 800 to 1000 instead of 200 patients.

This divisional hospital is also mobile, and apparently its chief function is to give the wounded shelter for but a few days. The patients must lie upon the ground as the hospital is rarely provided with cots; the operating-room has a fair equipment only. Then there is further transportation back to the base hospital which, as a rule, has the equipment of a modern civil hospital.

For armies which are constantly moving forward or backward, this

make-shift method may be all that is possible, but when the armies are entrenched as they are now on the western front, as soon as it is possible to collect the wounded, they can probably be transported rapidly in train or automobile ambulance to a base hospital. As I have written before, Carrel's hospital is nine miles behind the firing line. When the combating armies are moving forward and backward, as in the eastern area, base hospitals must be far to the rear, and the intermediate dressing stations and the mobile divisional hospital become essential. Here, also, it seems to me is the greatest opportunity for the flying automobile surgical hospital units. Properly supplied with means of transportation, this unit should prove more mobile than the divisional hospital, should get to the front more quickly; rescue, treat and transport the wounded; move back rapidly when the army retreats; move forward if it advances, or move to other parts of the line when the zone of activities changes.

All of the manuals of the different armies of the world give explicit directions as to the methods of treating and evacuating the wounded, but it is always explicitly stated that this is a working scheme only and that everything must be changed to meet the demands of the occasion. In this country, as yet our ambulance service is transported by the obsolete army mule.

I get the impression from a very extensive reading of different views of men now actually at the front that it is of the greatest importance to shorten the time between the injury and the first efficient treatment. Inefficient first aid, bad immobilization, uncomfortable transportation bring the wounded to the base hospital in such a condition that our present methods fail to give the best results.

With the ordinary rifle-bullet wound, except for compound fracture of the femur, simple first-aid measures were sufficient, immobilization not difficult, and rough and prolonged transportation not such a serious matter, but in this war the majority of wounds are large when produced by shrapnel, grenade or shell fragments. In addition to the fragments, there are other foreign bodies. Here the ordinary first-aid measures are of no value at all. To paint such a wound with iodine with the hope to have it heal is ridiculous. This type of wound must be transported quickly to the rear and to a hospital so improvised that an immediate surgical intervention is possible. These wounded must be anesthetized, the wounds opened, foreign bodies extracted, hemorrhage checked, provision made for drainage, the wound immobilized; the patient given tetanus antitoxin, and any other protective serum. They then are in shape to be transported to the base hospital for dressing. This change can only be accomplished by transporation by automobile or aëroplane and by moving the surgical operating-room nearer the firing line. I am confident the results would be better if these interventions could be done as soon as possible after the injury, and after as short a transportation

as possible. I am confident that after this surgical intervention the transportation further to the rear would be less painful and delay less disastrous.

Railroad Trains. In a letter[1] from Paris dated June 3, 1915, it is stated that in the beginning of the war on the French side transportation was very ineffective, but by April 29, eight months after the beginning of the war, the new methods began to show themselves. On this date wounded soldiers from Yser during the battle of April 28, reached the station at La Chapelle. This rapid progress was due to the greater number and greater efficiency of the so-called medical service trains. The letter describes in detail the character and equipment of the three different kinds of medical trains. In the first type the coaches have been reconstructed for the special use of wounded and are for wounded which must be transported reclining; in the second type the less severely wounded are carried, especially those who are able to sit up; here the ordinary coaches are employed and even baggage cars. In the third type, for emergencies only, ordinary coaches and baggage cars are employed, and these cars are fitted up with suspending litters. With each train there are special cars; operating-room, dressing-room, pharmacy, kitchen, dining car. At the time of the writing of the letter, there were 200 such trains.

Payr praises the arrangement of the luxuriously equipped hospital trains that he has observed with the German army in the North of France.

Hospital Ships. Pannett,[2] quoted by Blech, disagrees with Surgeon-General Rixey of the United States Navy. It is his opinion that hospital ships should not accompany fleets, but should remain at some distance from the fleet engaged in battle, and, when necessary, the wounded should be transported to the hospital ship by torpedo destroyers. In the present war the English hospital ships have proved very useful. Pannett's experience has been gained on the hospital ship Liberty. The operating-room is in the middle of the ship, five feet below the water line. Here, even in rough weather, there is little motion.

Last year I described[3] the fitting out of hospital ships.

J. C. Kelly[4] gives us a description of the first treatment of the wounded on the battleship Tiger during an action January 24. The medical corps was divided into two parts and stationed fore and aft below the fighting decks. They were well supplied. Their environment was that of an operating- or dressing-room in a modern hospital. As long as shells did not reach this part of the ship, they were prepared to give the wounded the very best attention. Many of the wounded came

[1] Journal of American Medical Association, 1915, lxiv, 2151.
[2] British Journal of Surgery, 1915, ii.
[3] Progressive Medicine, December, 1914, p. 191.
[4] Lancet, May 1, 1915, p. 962.

for help before action was over, others were found after firing had ceased. He reports in detail 11 cases; 4 were burns. These patients were given morphine, and the wounds were treated with picric acid. There were five fractures, all of smaller bones, except one of the femur. The case of fractured femur was given morphine and placed in a proper splint. Although it was a compound fracture, nothing is said of how the wound was treated. As this case and others were transferred at the end of twenty-four hours, we know nothing about the result.

This paper of surgeon Kelly demonstrates how difficult it is for the surgeon to make those records that are essential for our investigation in the confusion and excitement of battle. Then, again, the wounded are removed so quickly that the surgeon has no opportunity to follow his results.

We can learn, from this report, the good results of morphine. We know that picric acid was the first dressing for burns; we are informed that the patients were given both antitetanus and antistreptococcus serum. We know that they had no difficulty whatever in immobilizing the fracture, but, as to the treatment of other open wounds, there is no note.

In Case 5, there was a lacerated wound of the hand and a compound fracture of the metacarpus. This patient later was operated upon for divided tendon. One naturally asks the question why was not this done in the recent state?

Theory and Practice. On October 15, 1914, after the war had gone on for about two months, the German War Department published[1] official communications deprecating suggestions from others in regard to the transportation of the wounded. These suggestions, no matter how theoretically correct and good, were usually impracticable and impossible. The suggestions created discord and did not help transportation.

Here is an important piece of history from the medical standpoint. In the beginning of the war, the German army moved forward so rapidly that no attempt was made to have the hospital organization keep up with the advancing army. The wounded were rushed back from the firing line by the thousands, employing every possible means of transportation. As the railroads had been destroyed, this was often a difficult task. Hospital trains, even farther back where the railroads were intact, were side-tracked for trains loaded with troops and supplies for the front. The wounded were allowed to use the freight trains returning empty. Only the most seriously wounded were sent by these trains. Each of these trains was accompanied by a medical force. Later, hospital trains moved freely to and fro from the front.

Here is a good demonstration that when the hospital trains were

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[1] Deutsch. med. Wchnschr., October 15, 1914; Journal of American Medical Association, 1914, cxiii, 1965.

most needed it was impossible to use them, and empty returning freight trains had to be substituted, but, later, when both the pressure of the battle and the wounded had decreased, better transportation was possible.

Now, when one talks with military surgeons, one gets the impression that the care and transportation of the wounded are most difficult when the army is retreating, but here we are brought face to face with the difficulties when the army is advancing and we know, without quoting medical journals, the difficulties of getting at the wounded at all in trench warfare.

Apparently, it is much less trouble to equip a hospital train than to get it to and from the front.

Division Hospital. Rehn calls this the *Feldlazarett.* The distance between the first dressing station and this first hospital varies according to the exigencies of the occasion. Such a hospital, as a rule, has an equipment for two hundred wounded. In Rehn's experience, the number was sometimes as high as eight hundred to one thousand. In the majority of the armies, these field hospitals carry an equipment for the temporary care and shelter of the wounded. As a rule, there are no cots or mattresses. The operating equipment is more extensive than in the first dressing station, but as the number of wounded is larger, the executive work is much greater. As Rehn writes, it requires an executive chief of full mental and physical size to bring order out of chaos and keep the hospital going.

In this hospital the wounded get a little longer rest. There is opportunity for better examination, for a brief record, for taking temperature. Only the most necessary operations should be done, but these can be performed here with rubber gloves and with all the necessities of a modern operating-room. Of course, when the number of wounded is very large, material may give out.

I have discussed elsewhere the so-called automobile surgical hospitals. This undoubtedly will be substituted for the division hospital when possible.

Rehn is of the opinion that from the division hospital, patients and wounded in shock, threatened with bleeding, or in a dying condition, should not be transported.

Dr. Rudolf Lennhoff[1] describes, in a letter, his experience with a field or division hospital. He emphasizes, first, that this hospital equipment and corps must follow the troops to which it is assigned, so that the wounded are received, treated, and as quickly as possible transported to the rear. The surgeons, therefore, are constantly saying good-bye to the wounded whom they treated first, seldom knowing the late results of their efforts. He mentions, however, one case which showed

[1] Journal of American Medical Association, 1914, lxiii, 2253.

that conservatism with a bullet wound perforating the stomach may be favorable. This wounded sergeant returned in five weeks after a perforating bullet wound of the stomach. No details are given as to how this perforating wound was diagnosed.

Then there follows a short description of the many different types of wounds, but there is nothing in this letter to allow one to get at the actual working of a field hospital. One, however, gets the pleasant impression that the majority of the wounded seem anxious to get treatment at this hospital and return to the front to fight again rather than be sent to the rear.

Bowlby's[1] experience has been chiefly in division hospitals. He calls them clearing hospitals or clearing stations. They are the places to which the wounded are taken after being looked after or dressed in the field or first dressing stations. Sometimes a few of the wounded arrive in a few hours after they are injured. The usual interval is from twelve to eighteen hours, less frequently one to two days.

Their general condition is depressed from the shock of the wound, from hemorrhage, from exposure to cold and wet, and from starvation.

It is not unusual at such a clearing station to treat over one hundred compound fractures, besides five or six hundred other wounds in twenty-four hours.

In view of the delay between the injury and the first opportunity for proper treatment, and in view of the primary infection of most of these wounds with foreign bodies impregnated with the highly septic manure soil, Bowlby is of the opinion that it will be impossible to prevent suppuration, and the treatment must be antiseptic. He advocates painting the surrounding skin with iodine; the washing out of the wound with one to twenty parts of carbolic acid or iodine, one to two drachms to a pint. In extensive wounds with fracture, especially of the thigh and leg, the patient should be anesthetized, the wounds opened and disinfected; foreign bodies should be removed; detached pieces of bone should be taken away. The dressing applied should be moist and antiseptic.

Oelsner[2] gives a brief description of his experience in the field lazaretto or division hospital in East Prussia and the treatment of about 900 wounded. According to Blech,[3] in his article on the German Sanitary Organization, a *Stabsarzt* is a batallion surgeon with the rank of captain. Oelsner held this rank in *No. 12 Feldlazarett* of the Eleventh Army Corps.

Apparently his division hospital was more than a receiving and distributing station. The hospital was improvised in a farm house near the firing line. He describes the confusion caused by the arrival of the

[1] Lancet, 1914, clxxxvii, 1427; reviewed in Surgery, Gynecology and Obstetrics, 1915, xx, 398, abstr.

[2] Deutsche Zeitschr. f. Chir., 1914, cxxxii, 184.

[3] Military Surgeon, 1915, xxxviii, 123.

wounded in great numbers, the pitiful condition of many. That a number of the wounded arrive many hours or days after receiving the injury, is indicated in his description of the stench from the suppurating wounds. This makes it plain, that even in a division hospital which is the first hospital behind the firing line, the wounded arrive in all stages and at varying periods after the infliction of the wound.

The first problem seems to be the sifting of the wounded according to the gravity of their injury: (1) to give relief to suffering; (2) to select those who should be operated on at once; (3) to dress and transport farther back all those cases in which this is possible.

He describes how the improvised operating-rooms are laid out. If the material is there, and there is something which will allow water to be boiled, there is little real difficulty. The most important statements in this article are about his experience with alcohol and a 3 per cent. solution of carbolic acid. He states that it is his opinion that Lister's carbolic method has been neglected. The flies were so numerous in the operating-room that aseptic technic was impossible. All instruments and other material were placed on, and covered by, sterile sheets and towels wrung out in carbolic solution. Wounds were dressed with gauze thoroughly wrung out in this solution.

Choloroform was the anesthetic employed, but many incisions were made under novocaine. Gloves were not worn.

The chief operations performed were craniotomies for head injuries, with apparently good results. Abdominal and chest injuries were left alone. Shell wounds were enlarged, foreign bodies removed, and the wounds disinfected and packed with the carbolic gauze mentioned. Apparently this German surgeon agrees with Godlee and Watson Cheyne. He describes how quickly suppurating and stenching wounds cleared up under this treatment. Undoubtedly, Wright and his followers would claim that the same result would follow frequent irrigations with salt solution. But, if the results are the same, the antiseptic treatment must be the one of choice in hospitals of this kind, because the number in the sanitary corps is too small to give the attention required by lymph lavage in a large number of wounds.

When one reads an article of this kind, he becomes impressed with the necessity of a perfect organization and of surgeons of special training to meet the demands in the emergencies of a division hospital. Oelsner is apparently a surgeon who has had more than the usual experience, and one can read between the lines in his article that much was done in the operating-room of his division hospital which would not have been done by a surgeon with less preparation and experience.

Von Rothe[1] expresses the opinion that the severer cases of injury of the head, chest and abdomen, should not be transported to the base

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[1] Loc. cit.

hospital for eight or ten days, but kept absolutely at rest with as short a transportation from the firing line as possible. We have just noted the opinion that head cases should be operated on, if operation is indicated, at this time.

If there is the slightest sign of infection in wounds of the extremities, especially in the region of the thigh, the wound should be opened, foreign bodies removed and proper drainage instituted before these patients are transported to the base hospital.

Fractures of the extremity and spine should be properly immobilized. This authority prefers plaster.

Base Hospitals. The wounded are transported from the division to the base hospital by the best available means—boat, train or automobile. It is quite possible, when the transportation is by boat or train, that an operating-room can be maintained for performing operations which become necessary during the transportation.

The base hospital, as a rule, is as well equipped as any modern civil hospital. It is stationary. Should the enemy capture the place the wounded would not necessarily be removed.

George Crile, of Cleveland, is strongly of the opinion that the civil surgeon of experience, when called upon for aid in time of war, should be allowed to take charge of a base hospital with his entire operating-room unit, that is, this surgeon moves from his own hospital with his own team to the military base hospital and begins his new work with the very best assistance. This suggestion should receive serious consideration. Alexis Carrel has established a base hospital near the firing line in France which is complete in every detail for the treatment of wounds and for the experimental investigation of unsettled questions.

The American units to the third division of the American Ambulance Hospital in Paris went from their home hospital more or less equipped as Crile suggested.

Harvey Cushing is of the opinion that the general surgeon should always have in his team an orthopedic surgeon and a dentist. Crile found a neurological consultant of great value.

Smoler's[1] description of a base hospital on the eastern front should be compared with Oelsner's of a field lazaretto or division hospital. It was there noted that Oelsner operated with good results on head injuries. Smoler confirms this, because he states that when head injuries reach the base hospital it is usually too late to operate, and he urges that this be done nearer the firing line.

Transportation to Smoler's base hospital was unusually slow. All his patients complained of their long and painful journey. The earliest cases reached there only after two days.

Another very important statement of Smoler is his emphatic advocacy

[1] Beitr. z. klin. Chir., 1915, xcvi, 25.

of a uniform stretcher. This had been gotten up by Oettinger, but not adopted by the army authorities. Crile and Cushing also emphasized the importance of a uniform standard stretcher.

The patients received in this base hospital in the best condition had bullet wounds, with and without compound fracture. Smoler praises the first dressings of the wounds and the fixation of the extremities in this group. Many of the cases had been dressed only once. He, however, states that the chief neglect was the failure to leave a note on the dressing of its date and of the nature of the wound, because a number came through which should have been redressed and a number were redressed in which it was not necessary.

This county base hospital on the eastern front was suddenly ordered in commission, and about 370 wounded were placed in the hospital with a 280-bed capacity. Within one month the wounded were ordered out, and the hospital was converted into one for contagious diseases—an example of the emergencies of war.

INFECTED WOUNDS. *General.* In an editorial[1] based on English contributions, it is stated that the results of identical wounds in soldiers and sailors are different. The wounds heal without suppuration in the sailor. Of course, we know that the environment of a sailor on a modern warship is clean. It is easier for the sailor to have clean clothes and to keep clean. The opposite is true of the soldier.

W. W. Cheyne[2] makes a very important point that must be borne in mind in regard to the employment of antisepsis in the treatment of wounds.

Those who have written about the failure of antisepsis, and among whom Sir Almroth Wright is most prominent, are basing their conclusions on the fully developed septic wound. Here free drainage and frequent irrigation are most important. Cheyne is willing to concede that antisepsis cannot compete with free incisions and constant irrigation. He writes that we must look upon two stages in the history of wounds of war: One, before sepsis has become established; and the other, the second stage, after sepsis has taken root. In the first, and early stage, antisepsis has a distinct place.

Cheyne also calls attention to the fact that the difference between wounds in war and those in civil practice is chiefly one of degree.

I would add here that the younger civil surgeon has had so little experience with infected wounds and compound fractures that he is inclined, as Watson Cheyne says, to look upon the gun-shot wound as something peculiar and special.

It is my opinion that we should listen attentively to this warning of Watson Cheyne, and not eliminate antisepsis in the treatment of the early stage of wounds.

[1] Journal of American Medical Association, 1915, lxiv, 1765.
[2] Lancet, May 1, 1915, p. 961.

Wright's method—lymph lavage—will be discussed under that title, to be followed by Whitehouse's amplification.

Right here comes in appropriately the memorandum on the *treatment of the bacterial infection of projectile wounds.* This memorandum is by Burghard, Leishman, Moynihan, and Wright.[1] Apparently this committee is exchanging ideas, gathering facts, and attempting to get at a uniform method which will yield the best results.

As I have stated again and again here, the startling and apparently unexpected wounds of this war are those of artillery and grenades— wounds which always carry foreign bodies and are never clean cut. Up to the present time most of these wounds have been infected. The percentage of infections has increased with trench fighting.

The chief organisms are streptococci, tetanus bacillus and the gas bacillus (variously called B. aërogenes capsulatus and perfringens). Apparently much has been done to prevent tetanus by the immediate employment of antitoxin.

It is the unanimous opinion of this committee that the sooner wounds of this kind are freely opened the better. At this time all foreign bodies should be removed, necrotic tissue cut out, blood clot carefully detached, vessel injury, if possible, ligated. The wound should never be completely closed, and provision should be made for the widest drainage. From now on there should be constant irrigation and moist dressings.

The difference of opinion is in regard to the employment of antisepsis. Wright and his followers, who have really had little experience in the past with infected wounds, seem to be of the opinion that antiseptics are of no value, while on the other hand the surgeons are of the opinion that we are throwing away a useful adjunct if antiseptics are discarded. They feel that the sooner these drugs are employed the better. When sepsis has taken root, we can expect less of antiseptics or, in fact, any other measures.

As to the vaccines, we have as yet absolutely no proof. There is, first, the vaccine against anaërobic and against the streptococcus. This vaccine can be given as quickly as possible after the wound in a prophylactic dose, and later can be employed as one of the weapons in fighting the late stage of tetanus.

As far as I know, nothing new about vaccines has been discovered since the war began. Before the war, surgeons had come to a pretty definite conclusion as to how much help they could get from a vaccine in a severe case of sepsis in which they really needed it.

As far as my own experience goes, and as far as I can judge from the literature, this help has been absolutely negative.

For example, in the memorandum just referred to, it is stated: "A streptococcus infection which takes the form of erysipelas can

[1] *Lancet*, April 24, 1915, clxxxviii, 873.

practically always be promptly extinguished by an injection of strepto-
coccus vaccine without recourse to any surgical measure."

Every surgeon of any experience with infections knows that for
erysipelas of this type there is no measure indicated, and that in the
great majority of cases this form of a streptococcus infection gets well
of its own accord.

With the greatest respect for the committee, and with a deep ap-
preciation of their difficulties, I am chagrined to see that this sentence
"can practically always be promptly extinguished" has slipped into
their report.

BACTERIOLOGY. The literature shows that even before the war
there was a reawakening in bacteriology, especially in its practical
applications. The huge number of wound infections has given another
impetus to the investigation of their bacteriology, and the results, of
course, of this investigation will be of great economic value, providing
something is accomplished before the war is over.

The editorial[1] in the *Journal* goes over the ground and gives references.
When I discussed the Welch bacillus and gas phlegmons in PROGRESSIVE
MEDICINE for December, 1899, this infection was unusual, as it always
has been in recent years in civil surgical practice. But it would look
as if in this war the gas phlegmon is a common form of wound infection.

In reading, we must remember that the Bacillus putrificans (Metsch-
nikoff) may be a little different organism from the Bacillus aërogenes
capsulatus (Welch) which is probably identical with the Bacillus per-
fringens.

Lymph Lavage (Wright). Wright[2] is contributing a great deal
to the treatment of infected wounds. I have already mentioned it.
Further reading gives me the impression that, from an academic aspect,
it is most delightful reading, but it is difficult for a practical surgeon
to see anything new or different in Wright's so-called *lymph lavage*.
It is also to be remembered that he has given his physiological suggestion
mighty good company, that of free opening and drainage of the wound.
Surgeons who have given attention to the treatment of infected wounds,
and younger surgeons who have taken the trouble to read the older
literature, will find that there is nothing new in Wright's method,
except its delightful presentation.

The opening of the wound, the free drainage, the counter-incision,
the frequent irrigations, the moist dressing, or the continuous bath have
constituted the treatment of infected wounds for many years. I was
putting gas gangrene in baths in 1894, and at that time we placed
patients whose limbs had been amputated for infections in the bath
directly from the operating table. This has all been discussed in previous
numbers of PROGRESSIVE MEDICINE.

[1] Journal of American Medical Association, 1915, lxiv, 438.
[2] Lancet, April 24, 1915, i, 4782.

We cannot use bichloride of mercury and carbolic acid for frequent irrigation, or for a continuous wet dressing. There seems no doubt that the only possible material is water. There is no objection to salt solution, either hypo- or hypertonic, but, from a very large experience with the bath treatment of the worst forms of infection, I think I can show that ordinary tap water is as good for washing purposes as a salt solution of any strength.

Wright's contention against antisepsis has already been commented upon when discussing Cheyne's remarks. Perhaps, in this late stage antisepsis is least efficacious, but that it has no application at all, is, in my opinion, a dangerous view and should be chalenged and combated. We should not use any antiseptic in which there is danger of toxemia from absorption. Weak solutions of carbolic and bichloride present this danger, but numerous experiences with the wiping out of large, open infected wounds with pure carbolic acid, with alcohol, with iodine, and with ether, have shown that there is no danger of any toxic effects.

I believe that I can present as much evidence to prove that these antiseptics have helped, as Wright has shown that they have not.

Conceding that we cannot kill all the bacteria, that is no reason that the killing of some and the inhibiting of the action of others is not helpful. We do not have to anihilate an army in order to vanquish it.

It is my opinion that the accumulated evidence of civil and military surgery favors the employment of antisepsis, but not antisepsis alone.

I also agree with Cheyne that Wright has not by any means proved that there is such a thing as lymph lavage.

Irrespective of whether Sir Almroth Wright is correct or not, he has created a controversy, and at least has called attention to a treatment well known to older surgeons and to younger surgeons from reading the older literature. The only harm that these contributions of Wright can do is to take away the average surgeon's confidence in antisepsis. We know, in operative surgery, that a rather dirty surgeon will get fairly good results with drainage and antiseptic methods, while with asepsis alone his failures would be known to all. I am inclined to think this should influence us to use antiseptics as soon as we can in these shell wounds.

Whitehouse[1] treated a series of shell wounds with Wright's hypertonic saline solution. He observed sufficiently good results, he thought, to prove the correctness of Wright's views, but he was not satisfied. Although Wright observed sufficient lymph lavage, Whitehouse wanted more. For this reason he increased the osmotic power. (We must recollect that Cheyne thought that Wright did not mean osmosis, and that it had appeared in print due to an error, or as Sir Watson writes:

[1] Lancet, April 24, 1915; reviewed in Journal of American Medical Association, 1915, lxiv, 1880.

"That must surely be a slip of the pen.") Whitehouse added, to the hypertonic salt solution, liquid glucose containing sufficient phenol (carbolic acid)—1 to 80. This solution was applied directly to all the wound surfaces. Now the results exceeded Whitehouse's most sanguine expectations. In a few hours everything was saturated with lymph; quickly the purulent character of the discharge changed; in a day or two there was healthy granulation tissue.

Now, if this is true, this treatment of Whitehouse is more specific than salvarsan for a luetic gumma.

Whether it is true or not, what credit is to be given to the carbolic acid?

When we read Whitehouse's summary of his wound treatment, it contains all of the best principles—removal of foreign bodies, free incision and drainage, removal of necrotic contused tissue and blood clot; hydrogen peroxide; now, lymph lavage by the application of a solution of phenolized glucose. The older surgeons would call it a wet dressing. Apparently, Whitehouse has no objection to some antisepsis.

INCISION AND EXCISION. In all of the general articles on wound treatment, one gets the impression that the older rules of non-interference do not apply to shell wounds, especially if the wound has been received in trenches. Ultimately all of these wounds are operated on. The operation usually consists in wide incision, the removal of foreign bodies, further provision of drainage, if necessary. There seems no question that if this is indicated at all, the sooner it is done the better, and provision should be made to allow this operative procedure to take place as soon after the infliction of the wound as possible.

Milligan[1] goes further. He not only opens the wound and removes foreign bodies, but with a sharp knife he excises contused, lacerated and anemic tissue. He objects to antispetics, at least strong ones, and prefers asepsis throughout.

I get the impression that in the formidable shell wounds this would be a pretty extensive operation. It does not impress me as a thing to be done, except in smaller wounds. This method presents many difficulties: One cannot always be certain as to the viability of tissue, and, in doing this, one might sacrifice important vessels and nerves; if infection were present, it might be disseminated.

WOUND DRESSINGS. *Economy.* Franke[2] describes his methods of saving of wound dressings. In the first place the wound dressing is not changed unless indicated by the condition of the wound, and not of the dressing. Second, the gauze employed, both for wound dressing and for sponges, is used again and again. The gauze employed

[1] British Medical Journal, June 26, 1915; Journal of American Medical Association, 1915, lxv, 463.

[2] Zentralbl. f. Chir., 1914, October 31, 1914; Journal of American Medical Association, 1914, lxiii, 2169.

on the wounds should be made of certain sizes so that it can be applied and removed with the least cutting or no cutting at all. This gauze, when removed, is soaked in the lye which has already been used in the laundry. At the end of twenty-four hours it is washed in fresh lye, then rinsed, dried, and sterilized. Franke claims to have used gauze from six to eight times. When the gauze sponges become raveled, a number are wrapped together in a square of mull and used for a dressing pad. In this way the gauze can be used to the last scrap, and in this last form it is really sterilized lint. Much of the work, especially the ironing, is done by convalescents.

In times such as these the wisdom of such methods makes a greater impression. The real time, however, to practise economy is when you do not have to, when it is not forced upon you by circumstances, for example, in the well-endowed hospital in time of peace. It will be more difficult for the surgeon to do his work well when economy is forced upon him, as in time of war. It is a good time now for American surgeons to study economy of material in wound dressings.

Painless Dressings. In non-infected open wounds and in the late healthy granulation stage of the previously infected open wound, there is no necessity for the wet dressings which must be frequently changed. We now want a dressing that will not stick to the granulation tissue, is comfortable when it is on, painless during removal. The spreading of any semicold ointment on gauze takes time. Recently, I have taken an ordinary boric ointment, liquefied it in a large dish by heating, and then, with the gloved hand, immersed the gauze roll in this liquid ointment. It was then placed on the granulating wound. It is a very simple and painless dressing for granulating tissue.

Lumière[1] employs compresses of tulle with a mesh of 2 mm.; between the compresses a piece of paper; then this is sterilized in a mixture containing petrolatum, wax, castor oil, and balsam of Peru.

One can see at once that this is a more complex method to obtain the same result. Of course, we must remember that this ointment dressing has been used for years in the stage of healthy granulations. I think I have solved the question of its thoroughly clean and rapid application.

Wilcke[2] pours into open, ragged wounds liquid paraffin containing iodine one part in three hundred. On granulating wounds, he places a salve in which there is one part of iodine and one part of potassium iodide to one hundred parts of petrolatum.

Adhesive-strap Dressings. Eisner[3] calls attention to this old method, the efficiency of which has been established; nevertheless, to a certain extent it has become a lost art. When the granulating wound is clean

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[1] Journal of American Medical Association, 1915, lxiv, 1777.

[2] Med. Klinik, April 18, 1915; Journal of American Medical Association, 1915, lxiv, 1882.

[3] Deutsche Zeitschr. f. Chir., 1915, cxxxiii, 83.

and the bluish zone has appeared between the skin and granulation tissue, it is time to use the adhesive straps which are placed over the granulating wound imbricated. I have never lost this old method of dressing, but we do not have many of these large granulating wounds, and, undoubtedly, the modern teacher of surgery never mentions it to the students.

It is my rule to disinfect the granulation tissue with pure carbolic acid followed by alcohol. Before placing the adhesive straps on the wounds, they are passed through an alcohol flame. I have never found this dressing to be uncomfortable. If there is much discharge, the adhesive straps will be lifted off; if the wounds are carefully watched, odor or loosening of the straps—indications for changing the dressings— will be readily noticed.

Peroxide of Hydrogen. Spiro[1] is of the opinion that it is not the oxygen in the peroxide which affects the gas-forming organisms, but the mechanical effect of its effervescence: the frothing of the peroxide, as it comes in contact with the tissues and the discharge, forces gas into the tissues, and in this way exposes various recesses to the air.

My experience with gas bacillus infection was with free incision without the use of peroxide, with results apparently as good as those reported with peroxide.

Sugar. Spiro,[2] in the discussion of the employment of sugar in the treatment of infected wounds, is of the opinion that the results are not due to the product of fermentation, but to the fact that carbohydrates may alter the predominance of certain varieties of microörganisms. In most wounds, the infections are mixed. The placing of sugar in wounds might alter the proportion of bacteria present.

I mention this here to bring out the fact which is occurring quite frequently in the literature since the war that many writers are trying to explain how certain drugs act in the treatment of wounds, when really we have no positive evidence that the drugs act at all. I know of no positive clinical evidence that sugar has any beneficial effect on wounds.

We must remember that clinical evidence offers large opportunities for error. The modern surgeon has seen so little of infected wounds that his judgment as to the action of any drug or treatment is not reliable.

Silver Solution. The Danysz Method. Dr. J. Danysz,[3] of the Pasteur Institute, recommends the irrigation of open wounds with a dilute solution of nitrate of silver from 1 to 200,000 to 1 to 500,000. This weak solution is slightly germicidal and at the same time stimulating to the production of healthy granulation tissue.

[1] Münch. med. Wchnschr., No. 15, 497; editorial in Journal of American Medical Association, 1915, lxv, 878.

[2] Loc cit.

[3] Journal of American Medical Association, 1915, lxiv, 677.

In a later report,[1] it is stated that the clinical experience is favorable to this method.

The " New" Aptiseptic. The editor of the *Journal of the American Medical Association* for September 4, 1915, lxv, 880, calls attention to the new antiseptic credited to Drs. Carrel and Dakin. The latter is a bacteriologist. This antispetic is the result of mixing sodium carbonate in a solution of chlorinated lime; the mixture is shaken and about one-half hour later the liquid is syphoned off and filtered; to this clear liquid boric acid is added sufficient to make the preparation neutral or slightly acid. The editorial speaks of an interesting article in the *British Medical Journal* (August 14, 1915, p. 261). Dr. Cohen, of Leeds, a chemist, was to prepare the antiseptic, Dr. Dakin to test it bacteriologically, and Dr. Carrel to employ, clinically, those antiseptics which promised most from the bacteriological investigation. Apparently, a similar "triple entente" was formed between Prof. Smith, Dr. Rittie and Lieut. Campbell[2] of the British Army Medical Corps. This group was after a powder. They rubbed chlorinated lime to a fine powder and mixed it with the equal weight of boric acid. They were of the opinion that the antiseptic powder could be carried easier than a liquid and applied more readily on wounds at the front. The liquid solution of Dakin and Carell being practically neutral, may be applied in greater strength with less irritation than the powder.

The clinical results with either the liquid or the powder have not as yet been published.

Carbolic Acid. Rickman J. Godlee's[3] conclusion in March, 1915, was that we must go back to Lister's original method and use carbolic acid in undiluted form for the disinfection of these trench wounds in the recent state.

Since my reading of Lister's first communication on his treatment of compound fractures with pure carbolic acid, in conversations with Dr. Halsted, and in my own experience in the past twenty-five years, my respect for Lister has increased, and my faith in pure carbolic acid when properly employed has not diminished.

When civil surgeons open an abscess, for example, about the appendix, or when they remove a gangrenous appendix, or operate on a colon, they know that they cannot protect the originally clean abdominal wound from infection. A large percentage of these wounds break down, even though properly drained. Recently our results seem to have been better when we have employed iodine to disinfect the wound as we close it.

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[1] Journal of American Medical Association, 1915, lxiv, 1341.

[2] British Medical Journal, July 24, 1915, p. 129.

[3] Journal of American Medical Association, 1915, lxiv, 1257.

C. J. Bond[1] reports, from his clinical experience, that the application of pure carbolic acid to clean wounds does not affect healing.

Rochard[2] reports good results from strong solutions of carbolic acid. The details of how and when employed are not given in the Paris letter.

Iodine. Iodine has done so much for the civil operating-room, that I fear too much was expected of it in the present war.

In view, however, of its universal employment, and in view of the fact that evisceration of the intestines is not an infrequent complication of abdominal wounds, I wish to call attention to the experimental work of Frank,[3] which seems to prove that iodine is a bad thing for the visceral and parietal peritoneum. He even goes so far as to state that the intestine should not be allowed to come in contact with the skin which has been disinfected with iodine.

The editor of the *Boston Medical and Surgical Journal*, in going over the French literature from November 28, 1914, to March, 1915, and also from an article in the *Lancet*, April, 1915, comes to the conclusion that the experiences given in these papers favor the value of iodine as a first-aid treatment and for the subsequent antiseptic treatment of the open wound.

Crile and Cushing, in their discussion before the First-aid Conference in Washington, in August, expressed the opinion that all first-aid measures had failed in trench warfare, but one got the impression from their presentation of the facts that the failure of first-aid methods was due to the impossibility of any first treatment at all, so that they had no evidence to prove or disprove the value of iodine if applied at once to a wound in a trench.

It is pointed out in a Paris letter[4] that the iodine must be applied to the wound at once. A delay of a few hours apparently destroys much, if not all, of its value. Based upon this opinion the French government is supplying every soldier with an ampoule containing iodine which costs about two cents.

So far, in my search through the literature, I have been unable to get the real evidence which would show that iodine applied to the wound at once would have this beneficial effect. Many are of the opinion that in the hands of soldiers it would do more harm than good. At the recent First-aid Conference in Washington, the consensus of opinion of the railroad surgeons there present was against putting iodine in the first-aid package. Yet, most of these surgeons agree that when they used it they got excellent results. I am beginning to feel that, if tincture

[1] British Medical Journal, February 27, 1915; Journal American Medical Association, 1915, lxiv, 1195.

[2] Journal of American Medical Association, 1914, lxiii, 1868.

[3] American Journal of Obstetrics, 1913, lxix, No. 5; review in Surgery, Gynecology and Obstetrics, 1914, xviii, 229, abstr.

[4] Journal of American Medical Association, 1914, lxiii, 1967.

of iodine is really a good thing for accidental wounds, the best time for its employment is immediately after the infliction of the wound. I believe that we can educate people to use it with no greater danger than when it is used by the surgeon in the operating-room. We must recollect that painting the skin with iodine is a very old remedy in the hands of the profession and also an old domestic remedy. Iodine has to be used badly or too frequently to produce irritation. Apparently the majority of us are studying this question in our libraries and are not trying it out experimentally. For example, in the army there would be no difficulty in letting a thousand men paint small areas of their skin with iodine and then put on a first-aid dressing.

Artificial and Sunlight. E. Breiger[1] pleads for this photo- or light therapy for infected wounds in war, and states that we must not forget the results of Finsen and Rollier. He reports his experience with 65 cases, as follows:

"The lesions healed unusually fast and the scar tissue was strong; suppuration was checked early; the necrotic tissues were cast off promptly, while blood and serous infiltration in the region of the wound were absorbed more rapidly than under other conditions."

Backer,[2] from his experience in a mountain hospital, has been most favorably impressed with the results in healing when the open wound has been left exposed to light and air. To enhance the action of sunlight in cases where there must be fixation with plaster, he paints the cast around the opening black. When a dry scab forms, he lifts it up every five or six hours in order to let the air in. In exposing wounds to sunlight, the time of exposure at first must be short—fifteen minutes, gradually increased to two hours. This is done to prevent sunburn.

Alcohol. Saussailoff and Telitschenko[3] report on a series of laboratory experiments on the disinfecting properties of alcohol. Various bacteria, such as anthrax, etc., were placed in alcohol for twenty-four hours and then put in bouillon. Abundant growth was observed; 70 per cent. alcohol apparently had more effect, as these bacteria showed less growth in the same medium. However, when 10 per cent. alcohol, or even 5 per cent. alcohol, or 0.01 iodine were added to the bouillon culture nothing grew. Disinfection of the hands with alcohol gave almost uniformly negative bacteriological results.

In addition to this experimental work, their clinical experience for two years favors alcohol as one of the best disinfectants for the hands of the surgeon and the skin of the patient, and even for treatment as a wet dressing for infected wounds.

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[1] Medizinische Klinik, February 14, 1915; review in Surgery, Gynecology and Obstetrics, 1915, lxiv, 1113.

[2] Deut. med. Wchnschr., December 17, 1914; reviewed in Journal of American Medical Association, 1915, lxiv, 549.

[3] Surgery, Gynecology and Obstetrics, 1914, xviii, 229, abstr.

This was written in 1913. From the very beginning, in these reviews in PROGRESSIVE MEDICINE, I have called attention to the efficacy of alcohol. Practically today alcohol and tincture of iodine have driven from the civil operating-room all other disinfectants or antiseptics for the ordinary clean case.

In the recent war, ether has been substituted for alcohol in the treatment of infected and suppurating wounds. I have employed it quite frequently. It is pleasanter for the patient than alcohol, if they do not mind the odor.

AFTER-TREATMENT OF WOUNDS. The following so-called twelve commandments bearing on the prevention of crippling are of sufficient importance to be published in full. The rules are placarded throughout the battle and hospital zones of Germany. They are rules of ten neglected in time of peace, but in time of war the results of such wholesale neglect must be appalling.[1]

1. Remember that rest for joints (stiffness) and muscles (atrophy and loss of strength) is injurious.

2. Do not depend that, after the tissue lesions have healed, impaired motion can be overcome by orthopedic or medicomechanical after-treatment, but seek with all means at your disposal to prevent it and in grave cases refer the patients for after-treatment as soon as possible, in order that much time, effort and money may be saved.

3. Confine fixation of the joints to a minimum and strive to frequently interrupt it as soon as the healing of the wounds and fractures permits (change angle of position, motions).

4. Preserve as much as possible the precious strength in muscles jeopardized by rest, by early regular massage, electrization, and, under your own supervision, by active motions by the patient himself, with and without external resistances.

5. Bear in mind that extensor muscles succumb to atrophy much sooner than the flexors. Strive of all things to preserve for the arm its elevator (deltoid muscle) and for the knee its extensor (quadriceps femoris), for it is their weakening that most seriously impairs the function of the affected limb.

6. When the tissue lesions render protracted fixation unavoidable, place the joints in such positions that their eventual ankylosis will render it the least difficult for the affected limb to function, namely:

The *shoulder-joint* in the usual position of rest secured by a sling.

The *elbow-joint* at right angle.

The *forearm-joint* in inward rotation (pronation).

The *wrist-joint* in the overextended position naturally assumed when writing or firmly closing the fist.

The *finger-joints* slightly flexed.

[1] A. Ritschl, Deutsch. med. Wchnschr., 1915, xli, 132; Journal of American Medical Association, 1915, lxiv, 863.

The *hip-joint* slightly flexed and abducted.

The *knee-joint* slightly flexed.

The *ankle-joint* about at right angle and at slight inward rotation (supination).

7. Prevent the hand of an arm resting in the sling from gravitating into the flexed position, for this favors ankylosis of the fingers in extension and interferes with closing the fist.

8. Maintain the motility of the fingers. Do not unnecessarily include them in dressings, and never omit to admonish the patient to save his fingers from stiffening by continual extensive movements.

Preserve for the wounded his natural grasping apparatus, for an artificial hand is without sensation and therefore less valuable than a living remnant.

9. Stimulate the circulation of the blood in bed-ridden patients by motions of the limbs, also deep respirations, for increased circulation of the blood lends the inner organs beneficial stimulations and increases the nutrition and regenerative powers of the tissues.

10. Dispose of blood early extravasated into the tissues by means of measures furthering absorption (elevation, massage, heat, alternating douches, etc.), for coagulated blood acts as a constant irritant leading to adhesions in the organs of motion and, when present in large quantities, to the formation of masses of connective tissue. These latter, as a rule, cannot afterward be gotten rid of in all cases completely. Bear in mind that the blood and lymph circulation is interfered with more in the *ends* of the limbs and that spontaneous absorption must here under all circumstances be aided by artificial means.

11. Do not consider it below your dignity to early seek the advice and aid of an experienced colleague in all doubtful cases and, where your own technical ability does not seem sufficient, for you will learn thereby, and the injured will profit by it.

12. Do not despise the purely mechanical, for our motor apparatus is a marvellous mechanism. But only he is able to set in motion a complicated machine who knows its mechanism and is a good mechanic himself.

HEMORRHAGE. It is almost amusing to read the first-aid manuals on the arrest of hemorrhage, and to listen to surgeons discussing what they would do for hemorrhage. It reminds me very much of a country doctor who, when he first went into practice in a small town, was never without his instruments for emergencies; they were under his bed while he slept, in his office when he saw patients there, under the seat of his buggy when he drove about the country. But during the first five years of his young life he never had an emergency; not because they did not happen in his neighborhood, but he and his instruments were never there at the proper time. Now, on the firing line, it is not only difficult for the surgeon to be there with his instruments at the

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time of the bleeding, but, even if he is there, he can do little besides an attempt to clamp the bleeding vessel in a wound, or put on an Esmarch. If we give this advice to everyone, most accidental wounds will be treated for hemorrhage, as the bleeding is often enough to frighten the inexperienced into dangerous and unnecessary interference.

Wiewiorowski[1] emphasizes the difficulty of getting at the wound. In the daytime you can be seen, at night you cannot use a light; the wounded in the trenches, as stated before, are difficult to get out. The result is the surgeon does not get a chance to arrest hemorrhage. The soldier is either dead, or the bleeding has ceased of its own accord. Fortunately, the latter frequently takes place. Wiewiorowski feels certain, from his observations, that the use of the tourniquet should be forbidden, except by trained surgeons. In some instances an experienced surgeon will be able to ligate even without disturbing the blood clot. When soldiers have lost much blood, saline infusion can be given at the first dressing station or field hospital.

Jeger and Wohlgemuth[2] make a fibrous lint-like mass from a membrane taken from the intestines of sheep. It is frozen into a solid mass, then cut in thin slices so it becomes like fine thread; it is sterilized for three days in 5 per cent. carbolic acid and rinsed in alcohol. Before employing this soft fibrous mass on the bleeding surface, it is rinsed in salt solution. It seems to act well in capillary oozing and hastens coagulation. It is pressed into a wound like a tampon and left there. It is absorbed. It is my recollection that Dr. Halsted told me about this new discovery in Germany some months ago. It is interesting to note that he made this gut-wool at the time the Johns Hopkins Hospital opened in 1889, but the method was not published. Other methods of hemostasis in this clinic became so perfect that the gut-wool was neglected and abandoned.

Late Secondary Hemorrhages. Schloessmann[3] is quoted by Blech. This German surgeon observed his cases in Perthes's Clinic in Tübingen. Many of the patients died before they reached this base hospital, or came too late to be helped.

Hemorrhages of this kind are very rare in modern civil practice. They are complications of infected wounds, especially extremely septic ones. Schloessmann brings out the fact that these hemorrhages recur without any warning symptoms. They sometimes occur in an apparently healthy granulating wound. They often occur at night when the patient is asleep, even under the influence of morphine, so that the patients often do not know that they are bleeding until it is too late to help them.

[1] Berl. klin. Wchnschr., March 22, 1915; Journal of American Medical Association, 1915, lxiv, 1534.

[2] Archiv f. klin. Chir., 1915, cvi, No. 1; Journal of American Medical Association, 1915, lxiv, 279.

[3] Beitr. z. klin. Chir., 1915, xcvi, 129.

The secondary hemorrhages occur in wounds in which there had been a primary injury of a large vessel which at first became plugged with a clot, but later infection and suppuration separate this clot. I have observed such a secondary hemorrhage in a case in which the renal vessels had been clamped to save life in an emergency operation for rupture of the kidney. The clamp was removed in five days, the hemorrhage took place about fifteen days later.

This possibility makes Rehn's suggestion to auscultate injuries of the extremities much more important, because, if we hear the sound often present in the beginning aneurysm, we may institute primary ligation.

In other instances the vessels are secondarily eroded either from the pressure of a bone splinter or a piece of shell, or from the destruction of the vessel by sepsis.

Apparently the only treatment in grave hemorrhage is ligation of the artery above; on account of the suppurating wound, it is difficult to attack the bleeding-point. In less grave hemorrhages, pressure may be tried.

DUMDUM BULLETS. There has been so much written about this bullet that it seems timely to review a contribution of P. von Bruns.[1] We must recognize a dumdum bullet. There is no difficulty in doing this before it has been fired, because many types of bullets are so deformed after they have passed through soft tissue or bone, that their differentiation is impossible. Although the dumdum bullet produces a very typical wound with a range up to 600 meters, other bullets may produce practically the same type of wound at closer ranges. Apparently the dumdum bullet is dismantled and deformed even when it passes through or into soft parts only. This does not happen to the full-mantled bullet.

A dumdum bullet may be manufactured as such, or it may be secondarily created by the soldier out of a full-mantled bullet providing the kernel is composed of lead. Von Bruns expresses the opinion that it is very difficult to tell, from the character of the wound, whether it has been inflicted by a dumdum bullet. One must depend chiefly on finding the unused bullet in the cartridge belt of the soldier or the storehouse of the enemy.

Apparently the origin of the dumdum bullet was to stop barbarous nations in their fanatic and ferocious charges. As a rule the civilized army was small as compared with the number of its savage enemy, and before the development of rapid-firing guns a bullet of this kind was necessary for defense. This type of bullet is also used by hunters of big game. It would be a natural consequence that the English should have developed the dumdum bullet, and, as a matter of fact, it was first manufactured in East India at Dumdum near Calcutta. The lead

[1] Beit. z. klin. Chir., 1915, xcvi, 7.

kernel was covered by a steel mantle, except the tip (Fig. 32). This dumdum bullet is called by the soldier "soft-nosed." When it strikes, the soft lead expands and flattens (Fig. 33), the mantle behind it bursts into many longitudinal strips (Fig. 34). With a bullet of this kind the wound of entrance is not unusual, but the canal and wound of exit give the appearance well described in the term "explosive effect." Figs. 35 and 36 picture this explosive effect on soft parts and bone.
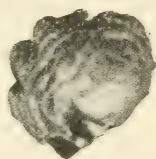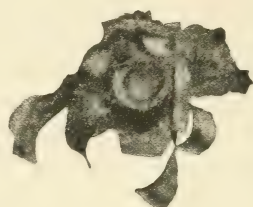
FIG. 32   FIG. 33   FIG. 34
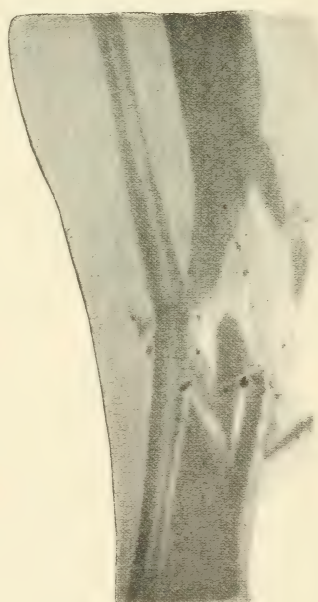
FIG. 35   FIG. 36

There is another type of bullet manufactured by the English, according to von Bruns, which has a similar explosive effect. It is a full-mantled bullet (Fig. 37), but there is a hollow space in the end of the lead kernel (Fig. 38). These jackets burst just as that of the dumdum bullet does. Von Bruns calls them "hollow-pointed" and pictures the various types of deformity assumed by them as they strike, differing in this respect but slightly from the true dumdum bullet. Then again,

a full-mantled bullet (Fig. 39) may be changed by secondary manufacture, or by the soldier himself, to have the effect of the hollow-pointed bullet. The end of the mantle is sawed off and a piece of the lead gouged out (Fig. 40). Then there is a new aluminum-mantled bullet with a pointed tip which, von Bruns claims, is a new invention of the English. To all external appearances it is a sharp-pointed, full-mantled, so-called "humane" bullet (Fig. 41), but this aluminum, cone-shaped point rests upon a lead kernel within the aluminum shell (Fig. 42). This solid aluminum tip can be easily broken, and the result is a dumdum bullet (Fig. 43). The tip can be broken off by the soldier before he fires the bullet, or the probabilities are that it will become detached when the bullet strikes, so that the effect will be explosive.
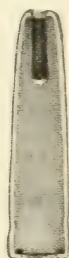
Fig. 37   Fig. 38   Fig. 39   Fig. 40
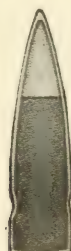
Fig. 41   Fig. 42   Fig. 43

At short range, von Bruns and other authorities agree, that all bullets may have this explosive effect, but it is these types of dumdum bullets that retain their explosive effect up to 600 meters. We know that in this war the great majority of wounds are shell wounds, and they appear to be almost as huge and ragged as the wounds of dumdum bullets. For some reason the explosive and the dumdum bullet is called inhumane and has been prohibited by international law, but if one gets the same effects from all bullets at close range, would it not be a natural reasoning to also prohibit fighting at such a range, as the results on the human being are the same?

This is the best explanation that I have read on the different types of dumdum bullets. We might call the last one—the aluminum-pointed bullet—the concealed dumdum. Apparently, there is such a thing as the dumdum bullet. Von Bruns also describes one found on the Russians, but he emphasizes the point that the positive demonstration of the employment of such bullets must rest upon the finding of the bullet, and not upon the character of the wound.

BULLET AND SHELL WOUNDS. Hoguet,[1] writing from his experience with the American Ambulance in France, states that as a rule fewer bullet wounds are infected than shell wounds, but since the trench warfare even the bullet wounds have shown an increasing number of infections.

He calls attention to the fact that it is often difficult to dress or to remove the wounded from the firing line for a number of hours. Even when they are collected and dressed, further delay is due to the difficulties of transportation.

When it is possible to get the flying automobile ambulances near the firing line to remove the wounded quickly and to dress them *en route*, the results as a rule are good.

He gives some excellent *x*-ray pictures of bullet and shell wounds. In both types, the fractures show great splintering. In the shrapnel wound there is a larger number of foreign particles, shell, and clothing. In addition, in the shrapnel wound the soft parts are more extensively lacerated and there is rarely a wound of exit. He emphasizes the importance, in a shrapnel wound, of early, free incision, removal of foreign bodies, and proper fixation.

Payr[2] writes of his experiences with the German army in the North of France. He emphasizes the different character of the wound produced by bullet, shrapnel, grenades, and the new flying arrow from the aëroplane. The latter may pierce the soldier, making a very small wound of entrance, and death follows from internal hemorrhage.

Apparently in this way the number of vessel injuries is larger. Payr also emphasizes that in a shrapnel wound there are usually found other foreign bodies. The simpler wound from bullets frequently heal without infection, even when joints are perforated. In wounds by bombs from aëroplanes there is always evidence of a burn.

Bullet Wounds. It seems to be the consensus of opinion and observation that the majority of bullet wounds heal, and intervention is not necessary. The greater number of infections in this war are in the shell wounds. Posnett,[3] from his experience, was impressed with the fact that bullets may pass through the most vital tissues, and yet no permanent injury results. The empty stomach is the salvation of the

[1] Jour. Amer. Med. Assn., 1914, lxiii, 2194.

[2] Berlin letter to Jour. Amer. Med. Assn., 1914, lxiii, 2242.

[3] Lancet, September 5, 1914; Jour. Amer. Med. Assn., 1914, lxiii, 1236.

soldier with a bullet wound of the viscera. Many cases recover without symptoms of peritonitis; a number, after signs of local peritonitis, show the symptoms of a localized abscess. These cases usually get well after drainage of the abscess. In bullet wounds of the urinary bladder, early suprapubic cystostomy prevents the extravasation of the urine. Bullet wounds of the kidney frequently heal without trouble.

Posnett also calls attention to the shock observed with bullet wounds. From the remarks of Crile and Cushing, one would get the impression that in many wounds this primary shock is absent—the soldiers experience no pain. Posnett, however, may have been nearer the front.

Then Posnett describes what he calls local shock. I think the term *contusion* would be better. It is his opinion that the soft tissues in the region of the bullet wound are distinctly affected, even when there is no laceration, due to the high velocity of the bullet.

Shell Wounds. Rehn is of the opinion that the number and character of these wounds has been the surprise of this war. They are all infected, and, if treatment is delayed until they reach the base hospital, the results are not good. From this experience Rehn would recommend that shell wounds be operated on as soon as possible. Of course, the first place in which this could be done would be the division hospital. The wound should be opened, foreign bodies removed, hemorrhage checked, loose, detached soft tissue removed; if necessary, incisions made for gravity drainage. The wound should be irrigated with peroxide of hydrogen (for the destruction of anërobic bacteria), then dusted with zinc perhydrol powder. Into the cavity should be poured balsam of Peru and the wound loosely packed with gauze. The patient should receive a prophylactic dose of tetanus antitoxin.

This is practically what is done at the base hospital, as a rule, when the wound is septic, filled with gangrenous material and often emphysematous. Surely a bad time, this, to expect much from any treatment. Yet, even in such a late stage, this treatment has yielded some remarkable results. It is quite natural to conclude that, if instituted earlier, it might prevent infection in some cases and limit it in all.

BURNS. The difference of opinion as to what is the best method of treatment for a burn in its recent state is as conspicuous as the neglect to follow well-established methods of treatment in the chronic stage. For this reason the contribution of Charles A. Parker[1] is a very timely one. He discusses and pictures the best methods of preventing contraction deformities. Most of it is plaster work in which at the present time the orthopedic surgeon excels and which is neglected by the general surgeon. Figs. 44, 45 and 46, from Parker, explain themselves.

[1] Journal of American Medical Association, 1915, lxv, 16.

GAS PHLEGMONS. Rehn[1] expresses the opinion that amputation should be a late intervention. Free incisions, the removal of foreign

FIG. 44.—September 24, 1913, showing extent of burn.
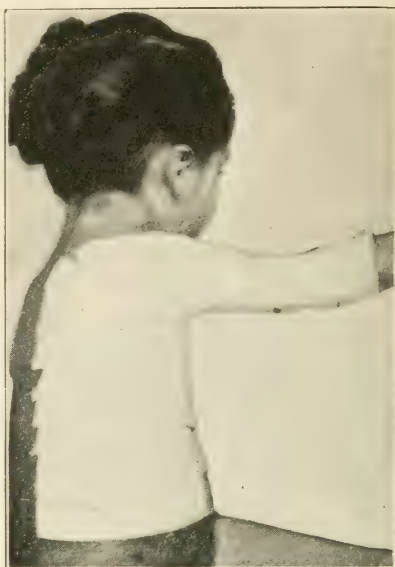
FIG. 45.—October 8, 1913, showing method of applying adhesive plaster.
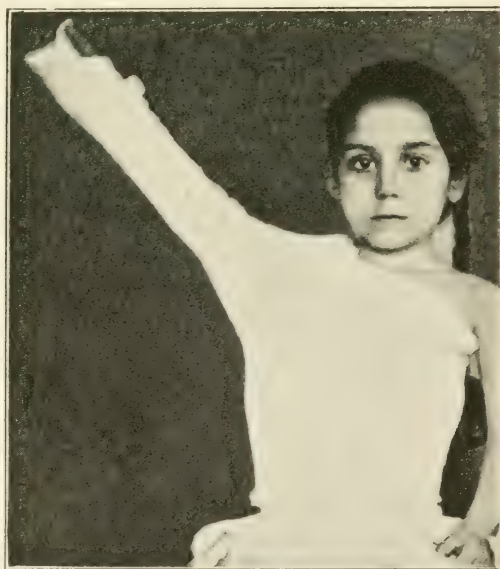
FIG. 46.—October 18, 1913, showing completed dressing, with removable plaster-of-Paris dressing.

[1] Loc. cit.

bodies and bath treatment are often successful. He reports one case of gas phlegmon in a shell wound of the thigh. The emphysema extended over the abdomen. Incisions were made, opening the wound widely, exposing the broken bone; necrotic fat and muscle were excised, the wound was thoroughly irrigated with peroxide of hydrogen. The patient recovered.

Lawson and Whitehouse,[1] quoted by Blech, report the result of their new method of treatment. In two months they observed 17 cases of gangrene; 14 of these were emphysematous gangrene; 3 due to injury of large bloodvessels. They agree with Rehn that amputation is rarely necessary; at least, in the first instance one should try free incision, excision of gangrenous tissue, irrigation of the wound with peroxide of hydrogen, and subcutaneous infiltration of the tissues above the area of gangrene with warm neutral hydrogen peroxide.

Morestin[2] advises the thorough disinfection of the wound, after it had been widely opened, with a solution of formaldehyde mixed with equal parts of alcohol and glycerin.

Dionis du Séjour recommends a 15 per cent. aqueous solution of oil of turpentine.

Quénu[3] disagrees with Delorme that subcutaneous injections of hydrogen peroxide are sufficient. The wound must be freely opened, foreign bodies, loose bone fragments and necrotic tissue removed. For emphysema above the gangrenous and necrotic tissue, Delorme's subcutaneous injections may be employed. In addition, Quénu recommends, for the treatment of the gangrenous portion of the wound, hot air of 500° C. This dries and mummifies the gangrenous tissue.

Another French surgeon, Paul Thiéry[4] recommends the hypodermic injection of pilocarpin in daily doses of 0.01 gram. This, with the wet dressings to the wound, produces what is called a veritable lavage of the blood. At first one is apt to laugh at such a suggestion, but we know that fever and sweats accompany infection, and the fever is looked upon as physiological reaction. Why not sweats? Yet, although many experimental pathologists, MacCallum and others, believe that fever is a physiological reaction, they do not advocate any attempt to increase the fever. If there is sweating with infection, is there any reason to increase it? If there is no sweating, should we induce it with pilocarpin?

Personally, I think we should be most careful with the employment of drugs in the treatment of infection, unless they are specific.

The great number of cases of gas phlegmons and infections in this war has startled the surgeons. I am especially interested, because I[5] saw my first case in 1895 and published a summary of 22 cases in 1899.

[1] British Journal of Surgery, 1914, ii.
[2] Journal of American Medical Association, 1915, lxiv, 1515.
[3] Ibid., 1914, lxiii, 1967. [4] Ibid., p. 2145.
[5] PROGRESSIVE MEDICINE, December, 1899, p. 158.

I was familiar with the discovery by Welch and Nutall of a gas bacillus which they had cultivated at autopsy in 1892. Welch and Flexner[1] made their first publication in 1896. I saw my first case in March, 1895, exactly twenty hours after a bullet had entered the knee-joint and lodged there. When I saw the boy, the joint was moderately distended with fluid, and, on palpation, I got crepitus, and as I expressed fluid from the wound of entrance this bloody fluid contained air bubbles. The possibility of a gas bacillus infection was immediately considered, cover-slips were made, and the bacillus recognized. Ever since then, in all the cases which I have personally observed, I have always been able to demonstrate the gas bacilli in the secretion from the wound, in some instances before emphysema was evident. I have always thought of this infection in bullet and gunshot wounds, in all compound fractures, wounds of all kinds in the region of the buttocks, and all soft-part wounds with signs of gangrene. This cover-slip diagnosis is rapid and certain. Bacilli of this kind are found in no other wound. In all of my published cases, and in most of those which I have observed since, the cover-slip diagnosis has been confirmed by cultures and animal experiment. I wish to emphasize this method of diagnosis, because gas bubbles in the wound secretions and emphysema are by no means uncommon and need not be due to the gas bacillus.[2]

In this number of PROGRESSIVE MEDICINE I wrote as follows: "A sufficient number of surgical cases have been observed to demonstrate the great importance of having in mind, especially in recent compound fractures, bullet and gun-shot wounds, the possibility of a gas-bacillus infection. The early recognition and proper treatment in the majority of cases have changed the usual fatal result into a more happy one." My report at that time was based upon 22 cases, with 13 recoveries. Over one-half of these cases I have personally observed in Dr. Halsted's surgical wards of the Johns Hopkins Hospital.

These cases can be divided as follows: Bullet wounds, 3 cases; all recovered. Gunshot wounds, 3 cases; 2 recovered. Compound fracture, 8 cases; 4 recovered. Lacerated wounds, 2 cases; both recovered. Phlegmons, 5 cases; one recovered.

The experience of that time, which has been confirmed up to the present day, has demonstrated that the most important factors in treatment are early recognition and free incision with the wound left open. The most extensive primary disinfection will not be sufficient if the wound is not drained. For example, in my[3] case 1, the knee-joint was opened twenty hours after the bullet wound; there was no sign of infection; the only proof of infection were the gas bubbles, the bacilli in the cover-slips, and the bacilli and streptococci in the cultures. The

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[1] Journal of Experimental Medicine, 1896, i, 1.
[2] PROGRESSIVE MEDICINE, December, 1899, p. 175.
[3] Ibid., p. 159.

joint was irrigated with bichloride 1 to 1000 for one hour, but as we had had no special experience with this type of infection, the wound was closed. Within twenty-four hours it was necessary to reopen it, and within five days to amputate the leg. The patient recovered.

The next bullet wound we[1] observed was much more extensive, but the wound was left open, and the limb was saved.

There is another observation of mine[2] which shows that antiseptics are not sufficient. This man's leg was amputated without any aseptic precautions on the field after a railroad accident, and the patient came into the clinic six hours later with a sutured, dressed stump. As the stump was distended with blood, it was considered best to remove the hematoma. There were no signs of infection, no emphysema. Under an Esmarch, the stump was reopened with all antiseptic and aseptic precautions, the blood clot turned out, and the wound irrigated with 16 liters of 1 to 1000 bichloride of mercury; the Esmarch was removed and two bleeding vessels tied. Five hours later, that is, about eleven hours or more after the accident, pain in the stump, chill and fever set in; upon examining the stump, we found emphysema. It was a most remarkable picture to me, as I had closed this stump five hours before; now I saw a red stump, tense, and, when palpated, the crackling of air or gas was distinctly marked to a position above the patella; one could also see the red lines of lymphangitis extending up to the groin, and there was edema. This man, who had been admitted to the hospital after a recent amputation with a closed stump distended with blood, complained of no pain, but five hours later the pain from the emphysematous cellulitis was excruciating. In this case I immediately opened the wound, found the gas bacilli in the cover-slips from the serum in the wound, amputated the leg above the knee without flaps, and placed the patient in a bath. He had no further pain, and made a good recovery.

There seems no question that the wound should be left open, but there is considerable difference of opinion as to how the open wound should be subsequently treated. If one knows how to manage the bath treatment, there is nothing simpler, or more efficacious. A wound immersed in water is irrigated constantly, but it is very difficult to get wounds not immersed in water to be irrigated at frequent intervals.

Perhaps the majority of writers on infected wounds recommend continuous bath treatment. M. Riehl[3] has been so much impressed with his results that he makes it the title of his contribution. It should be employed in all extensive burns and wounds, in all infected wounds requiring large incisions. The tub should be at least 110 cm. long; a blanket or air cushion is employed to keep the body from contact

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[1] Progressive Medicine, December, 1899, case 2, p. 161.

[2] Ibid., case 7, p. 164.

[3] Wiener klin. Wchnschr., November 19, 1914; Journal of American Medical Association, 1915, lxiv, 186.

with the metal of the tub; any temperature agreeable to the patient should be maintained; cooling off of the water is prevented by covering the tub with blankets. It is sometimes more convenient to transfer the patient to another tub filled with fresh water, than to change the water in the tub while the patient is still immersed.

In my experience, the best temperature is 99° to 100° F. The patient is most comfortable when he rests on canvas which can be adjusted to the sides of the tub by proper clamps. The arms and upper portion of the body can be kept out of the water when they are not involved in the wound. The ideal change, of course, would be a tub adjusted for running water at the proper temperature. I have never had the opportunity to employ a tub of this kind, but the water has been changed at intervals by syphonage and renewed from time to time from pitchers or pails. Once or twice a day the patient is lifted out of the tub on a bed, dried, and the skin oiled with lanolin or olive oil. I have kept patients in tubs for three weeks.

Oxygen. Sudeck[1] is of the opinion that he saved the life and limb of two patients with compound, comminuted fractures of the arm complicated with gas phlegmons. Sudeck introduced the oxygen into the muscular tissue with a cannula, producing a definite emphysema. It is to be noted that Thiriar plays a jet of oxygen on the raw surface. The technic employed by Sudeck was introduced by Müller who recommends this treatment, only without incision.

Bayeux[2] also recommends the subcutaneous injection of oxygen in gas gangrene and other infections. He injects it into joints and into the soft tissue with a special apparatus which he has used for five years. This allows measurements of exact doses.

Hydrogen Peroxide. This apparently is the most popular therapeutic agent for gas phlegmons. It is easier to obtain than oxygen. McKelvey[3] employed this drug as an irrigation after making large incisions; in addition, the wounds were also irrigated with carbolic acid in dilution of 1 to 100. The wounds were kept open by large rubber drainage tubes. Dressings were frequent, the patients having special day and night nurses. He reports that among the last seven cases treated in this way there have been no deaths.

In PROGRESSIVE MEDICINE for December, 1914 (p. 208), I have reviewed, with illustrations, the special self-retaining retractor of Max Tiegel (Figs. 47 and 48) and also (Fig. 49) Cramp's retractor-drain. These were gotten up for small wounds, especially in the region of the

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[1] Med. Klinik, November 22, 1914; Journal of American Medical Association, 1915, lxiv, 185.

[2] Presse Médicale, April 29, 1915; Journal of American Medical Association, 1915, lxiv, 2024.

[3] British Medical Journal, May 15, 1915; Journal of American Medical Association, 1915, lxiv, 2022.
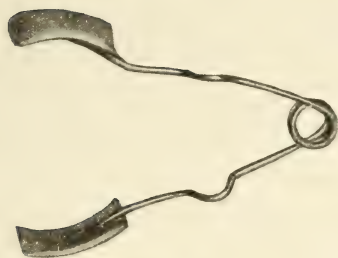
Fig. 47

Fig. 48

Fig. 49

fingers and hands. They could be easily enlarged for wounds of all types. A scheme of this kind would make gauze packing unnecessary to keep the wound open.

Spiro[1] recommends the addition of sugar to the peroxide of hydrogen.

Lawson and Whitehouse[2] make a rather formidable operation out of their treatment with hydrogen peroxide. The patient is first given the usual hypodermic of atropine and morphine; then follows narcosis, either general or spinal. An area three fingers' breadth above the advancing gangrene is disinfected, a small incision made to the fascia of the muscle; through this incision a forceps is introduced which bluntly separates the subcutaneous tissue from the fascia; then, through this incision, a syringe is introduced and neutral hydrogen peroxide is pumped in under pressure. This is continued until a belt of this injected tissue is complete above the advancing gangrene. Then the gangrenous area receives the same treatment. The wound itself is opened, foreign bodies and dead tissue removed, followed by irrigation with salt solution and hydrogen peroxide. The wound is then drained with rubber tubes and gauze.

From my experience with gas phlegmons, this treatment of the tissue above the line of demarcation has not been necessary, even when emphysema could be made out. When one properly treats the area of injured and infected tissue, it is sufficient. It seems to me that Lawson and Whitehouse make an unnecessarily formidable operation and waste precious time and material where this is not essential.

Quénu[3] voices the consensus of opinion when he writes that the most important factor is free incision, opening up every part of the wound to the air; hydrogen peroxide is a useful adjunct. Quénu also employs cinchona powder. For very severe wounds, he treats the surface tissue with superheated air. This treatment lasts fifteen minutes and requires general anesthesia. Quénu has already had experience with twenty gas-phlegmon wounds; all recovered, except two. In these two cases the shoulder- and hip-joint areas were involved in the wound and gangrenous process.

Vaccine. Weinberg[4] has prepared a vaccine for the different forms of gaseous gangrene, but as yet I can find no reports as to its effects.

Previous to the war there were interesting contributions on gas-bacillus infection by Plummer,[5] Hitzrot,[6] and Cramp.[7]

[1] Münch. med. Wchnschr., April 13, 1915; Journal of American Medical Association, 1915, lxiv, 2027.

[2] British Surgical Journal, January 11, 1915; Journal of American Medical Association, 1915, lxiv, 778.

[3] Journal of American Medical Association, 1915, lxiv, 861; Bull. de l'Acad. de Méd., January 19, 1915.

[4] Journal of American Medical Association, 1915, lxiv, 1173.

[5] Surgery, Gynecology and Obstetrics, 1910, x, 432.

[6] Annals of Surgery, 1912, lx, 624.   [7] Ibid., lvi, 544.

TETANUS. Rehn,[1] from his experiences, ventures no opinion as to the best treatment when tetanus has developed. He was impressed with the number of cases of local tetanus which he has observed. Apparently, the prognosis does not differ from that of the general type.

Alexius McGlannan has just presented before the Association of Military Surgeons of America an excellent review of the recent literature on tetanus, and courteously sent me a copy of his manuscript. The more recent investigations of Noble (1915) prove the wide distribution of the tetanus bacillus. It is found in the intestinal canal of many animals, especially the horse; it may multiply in these animals; some horses are practically tetanus carriers. This recent work, of course, only confirms the older views. One should always be suspicious of a wound contaminated with dust or dirt, especially near streets and stables. It is to be hoped that the automobile may reduce this wide distribution of the organism. The wads of blank cartridges are usually infected, and even some of the felt and other dressing employed for wounds. The only safe disinfection for this material is heat applied over a long period.

Apparently, tetanus has disappeared as a complication of operative wounds.

The most important features in the treatment of tetanus is the immediate prophylactic injection of the antitoxin—the sooner, the better. After forty-eight hours the results are much less certain. The usual adult dose is 1500 units, but, from experience in the present war, smaller doses have been employed—down to 20 units. The injection should be given around the principal nerve between the wound and the spinal column, but exposure of the nerve seems unnecessarily radical. This is a new point in the prophylactic treatment. In the past the majority of such injections have been made somewhere into the subcutaneous tissue of the abdomen or thigh, irrespective of where the wound was.

When McGlannan comes to discuss suspicious wounds, he covers the usual ground, but even in civil practice it is a question as to what constitutes a suspicious wound. Where shall we draw the line? It is my rule in civil practice to give a prophylactic dose in every accidental wound which has been contaminated with dirt. If the surgeon cuts himself in a clean operation, this protection is unnecessary.

There is no relation between tetanus and the character of the wound, that is, no positive relation. In civil life, wounds from rusty nails appear to be the most common accident followed by tetanus; in this war the big shell wounds, rather than the rifle wounds. In some of the cases, however, the wounds have been secondarily contaminated in transport cars recently employed for horses and not cleaned. It is

[1] Loc. cit.

possible for tetanus infection to pass by contact from one patient to another.

In addition to the prophylactic dose of tetanus, McGlannan expresses the opinion, that some wounds should be excised, deep punctured wounds opened and disinfected, and that moist dressings are best. As to local disinfectants, carbolic acid, iodine, iodoform powder, and Carrel's chlorinated lime and boric acid are recommended. On the whole, iodine seems to meet the indications, but this local treatment of the wound holds no importance as compared with the prophylactic injection of the antitoxin. It seems to me that the surgeon, in treating the local wound, should be guided by general principles. Tetanus can be controlled by the antitoxin. For this reason, if there is no clinical evidence of tetanus, the local treatment should not be influenced. If the wound, however, does not heal, the protective dose should be given perhaps every ten days. This is based upon the fact that the organism lives in the wound. I would hesitate in recommending these repeated injections, although McGlannan mentions it as recommended by Irons, in 1915. McGlannan also states that when one must operate upon an unhealed wound in which there may have been a tetanus infection, it is best to administer a prophylactic dose of the antitoxin.

Apparently all agree on the efficacy of the prophylactic injection, but when tetanus has developed, the problem becomes a very difficult one. Apparently the earlier the clinical signs of tetanus are recognized, the better the results if treatment is at once instituted.

The principle of treatment, according to McGlannan, may be divided into the following six phases:

1. The neutralization of the toxin in the cerebrospinal fluid and in the blood. This is accomplished by repeated injections of the antitoxin into the spinal fluid and vein.

2. Limiting, or preventing, the development of the toxin at the focus of infection.

3. Interruption of the flow of toxin from the wound to the central nervous system.

Opinions as to the local treatment of the wound to accomplish these two objects differ all the way from non-interference to complete excision or amputation. On the whole, the wound should be treated according to its local condition, that is, in relation to the local signs of infection. Some smaller wounds can be excised; all can be properly drained, but amputation will not cure tetanus. Many authorities prefer to inject the antitoxin about the wound and into the nerve or nerves above the wound, but McGlannan expresses the opinion that it is best to refrain from avoidable traumatism and rely upon the intravenous and intraspinal administration of the antitoxin.

4. The nutrition of the patient must be maintained.

5 and 6. The things which interfere with nutrition are those com-

plications noted in the fifth and sixth phases—prevention and control of convulsions and other muscular contractions.

In the first place the patient must be protected from every trauma through any of his cerebrospinal or peripheral nerves. Morphine hypodermically is the first drug to depend upon; then chloral hydrate. If these fail, magnesium sulphate should be administered intraspinally and subcutaneously.

Other methods of treatment, such as injections of dilute carbolic acid, are apparently not as efficacious as the treatment outlined.

The chief thing we have learned in this war is the widespread distribution of the tetanus bacillus, and the splendid results of the prophylactic injection of antitoxin. Second, early recognition from the most obscure signs. Before the war it seems to have been the consensus of opinion that the two chief factors in treatment were large, repeated doses of the antitoxin and the employment of magnesium sulphate to control the convulsions until the antitoxin had neutralized the poison.

The literature on this subject has been fully reviewed in my contributions to previous numbers of PROGRESSIVE MEDICINE.

McGlannan's complete article will appear in the new edition of Kelly-Musser's *Practical Treatment*.

Grundmann's[1] observations in a large base hospital confirm the position taken by McGlannan. In the first place, early recognition; look out for such slight symptoms as difficulty in swallowing, the starting of the patient from a bright light, a sudden noise or draft, the twitching of muscles from a light tap. Begin with the antitoxin at once, keep the patient quiet in a dark room, give nourishment every hour, leave the wound alone, inject about and above it the antitoxin, give daily antitoxin intravenously, give the antitoxin intraspinally on the first and third day; begin at once with magnesium sulphate, first, subcutaneously, three or four times a day, 20 c.c. of a 10 per cent. solution; begin perhaps with 5 c.c. The object of this is to control muscular contraction. The magnesium sulphate was not given intravenously, nor intraspinally. Grundmann makes another point important from the standpoint of the military surgeon: If you cannot isolate the case of tetanus, give the soldiers nearest to this patient a protective dose of antitoxin.

Reingruber[2] has had favorable experience from the subcutaneous injection of magnesium sulphate in 9 cases. It controls muscular spasm. Begin with the injections in the morning and repeat them every two or three hours until muscular rigidity is overcome. When it returns again the next morning, repeat the treatment. He employs a 20 per

[1] Berl. klin. Wehnschr., February 22, 1915; Journal of American Medical Association, 1915, lxiv, 1278.

[2] Therap. Monatshefte, March, 1915; Journal of American Medical Association 1915, lxiv, 1453.

cent. solution for a child and a 40 per cent. solution for an adult. The single dose is 0.2 gram. If the results of subcutaneous employment of this salt are as good as of the intraspinal administration, it would simplify treatment.

When the convulsions are not controlled by the subcutaneous administration, then the drug should be used intraspinally. Kocher[1] reports good results.

There have been a few reports of anaphylactic reactions after the prophylactic dose of the tetanus antitoxin. Boenheim[2] observed in one instance that the itching of urticaria was so intense that morphine had to be given. Then severe pain developed in the abdomen and bones. The symptoms lasted four days.

D. G. Smith[3] was very much impressed by the nine days' interval between the prophylactic dose and the anaphylactic symptoms which were unusual and excessive; a skin eruption lasting four days; after this had disappeared, edema of the face lasting six days. This edema would come and go. Then there was joint swelling and pain, associated with fever and delirium lasting one week. So that *in toto* there were twenty-seven days of illness. The patient recovered.

Cases of this kind are unusual, but in civil practice we must be constantly on the lookout for them, in order to allay the fear and anxiety of the patient and his family. I have been unable to find the report of any deaths from anaphylaxis after the prophylactic administration of tetanus antitoxin.

Voelcker and Eunicke[4] advise to be on the look-out for so-called rheumatism as an early sign of tetanus.

The rules of the French army in regard to tetanus have been given out by Roux[5] of the Pasteur Institute, and are published in full. It is now ordered there that every soldier must receive a prophylactic dose after an injury, at once, if possible. This is recorded on a special tag of a special color. If the wound is of a character in which experience would suggest a greater probability of tetanus, a second and third prophylactic injection should be made every second or third day. The danger of anaphylaxis increases when the interval between injections is ten days or more.

Irons[6] reports the experience from the Cook County Hospital in Chicago. He emphasizes the importance of early recognition and

[1] Deutsch. med. Wchnschr., November 17, 1914; Journal of American Medical Association, 1915, lxiv, 185.

[2] Berl. klin. Wchnschr., December 21, 1914; Journal of American Medical Association, 1915, lxiv, 549.

[3] Washington Medical Annals, January, 1915.

[4] Münch. med. Wchnschr., October 27, 1914; Journal of American Medical Association, 1915, lxiii, 2167.

[5] Journal of American Medical Association, 1915, lxiv, 67.

[6] Ibid., p. 1552.

treatment, the use of larger doses of the antitoxin, intravenously and intraspinally.

WOUNDS OF THE EXTREMITIES. This perhaps is the largest chapter in military surgery, not only because it represents the majority of the wounds, but for these wounds surgery offers the greatest hope of preserving life and limb and restoring function.

Von Rothe[1] discusses very fully, in a general way, these wounds of the extremities.

The non-infected wounds of the soft parts heal very rapidly. When there is infection, but no bone injury, the healing is a little less rapid. When the soft-part wound is due to shrapnel or grenade, it is naturally a larger wound and must heal more slowly.

In the non-infected wounds of the soft parts, the things that we must look for are hematoma, with or without bleeding vessels.

It is von Rothe's opinion that hematomas should be evacuated by enlarging the wounds of exit and entrance. If, when evacuated, there is evidence of bleeding, one should not ligate the main large vessel, but attempt to get the bleeding-point in the wound. He has had no experience with aneurysms and has never had to perform vessel suture.

I[2] have previously thoroughly discussed the subject of traumatic aneurysms. There is not much literature on aneurysms from the present war.

The great majority of wounds of the extremities which give the surgeon concern are the acute phlegmons, especially those due to the gas bacillus, and the suppurating compound fracture.

In the acute phlegmons the surgeon is called upon to act quickly. He does not wish to amputate, except to save life, and he does not wish to make the mistake of losing his patient, because he depended too long on free incisions.

In the infected compound fractures, the difficulty is the application of a dressing which will properly immobilize the fracture and at the same time allow the proper dressing of the wound. As I have repeated so often in this review, the surgeon of today has had no opportunity to prepare by actual experience for such emergencies requiring judgment, and at the same time the general surgeon as a rule is not proficient in plaster dressings.

I feel confident that every base hospital should have an orthopedic surgeon on its staff. The making of a plaster dressing with fenestrum presents no difficulties to an orthopedic surgeon. I am looking now at a series of photographs of such plaster dressings put on by Dr. Osgood, of Boston, in the American Ambulance in Paris. I am confident that no general surgeon would have been able to put on, or to direct the putting on, of these dressings unless he had specially prepared himself.

[1] Beitr. z. klin. Chir., 1915, xcvi, 181.
[2] PROGRESSIVE MEDICINE, December, 1914, p. 233.

I am hoping that Dr. Osgood will allow me to reproduce these in this journal.

Each wound in each individual case presents its own problems. Noone seems able to formulate a rule which will apply to all. Many factors enter into the decision how to act. We must have before us the knowledge that limbs can be saved without danger to life, and this should be our goal. At the same time we must know that in certain cases limbs must be sacrificed to save life, and as a rule there is but one time for its amputation. Again, we must remember that when we amputate in cases of this kind, we are not to do a Lisfranc or a Gritti, or any typical amputation; we are not making a stump, but we are getting rid of infected tissue which is threatening the life of the individual, and we leave as much stump as is possible without risking life. Later, if necessary, the stump can be made weight-bearing. Surgeons who criticize the stumps of military surgery are ignorant of the situation. The probabilities are that the good stumps made by less experienced surgeons never feel the artificial limb, because the patient dies.

Von Rothe brings out another important point in these bullet and shell wounds. The chief sign of infection is general and not local. It is the fever and malaise, and not the redness, swelling, and lymphangitis. The infection is within the cavity of the wound, in the blood clot, in the lacerated muscle, in the exposed marrow of the comminuted bone. The surgeon, therefore, must depend more on the general condition of the patient as to the indication for operation. Local manifestations are late manifestations.

COMPOUND FRACTURES. From the literature, from conversation with those who have been to the front, and from the lantern-slide demonstrations of Crile and Cushing which I have seen, one gets the impression that compound infected fracture is one of the most frequent injuries in this war. The majority of these wounds ultimately reach a stage in which the bone fragment must be held in position and at the same time this fixation must allow ready access to the suppurating wound. In civil practice, few surgeons have had much experience with such wounds and their dressing. In the present division of surgery, most of the plaster dressings are made by the orthopedic surgeon. A surgeon with this training is the one who finds himself at home with this requirement. It requires little adjustment to make a plaster dressing with a hole in it, if this hole is small; but as the hole, of necessity, must become larger, one's ingenuity is more and more taxed to adjust material and methods to bridge the gap. The pictures which I am about to reproduce are made available by the courtesy and generosity of Dr. Osgood, of the Orthopedic Department of Harvard University. He accompanied the Harvard Unit to the American Ambulance in Paris.

Perhaps the most available adjustable splint for the lower extremity is the Thomas adjustable splint. Fig. 50 shows this splint applied for

Fig. 50
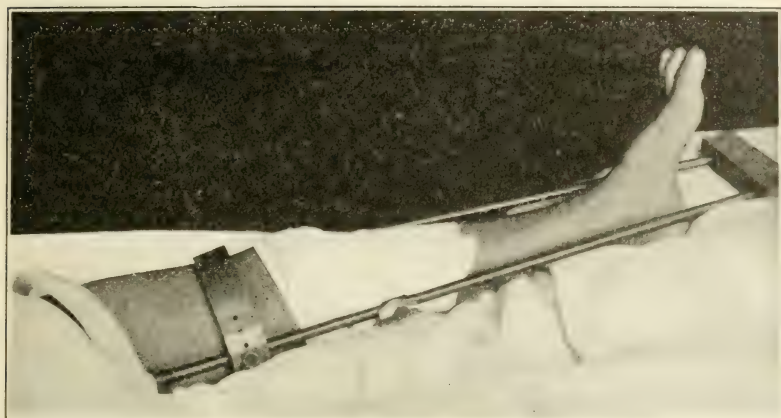
Fig. 51
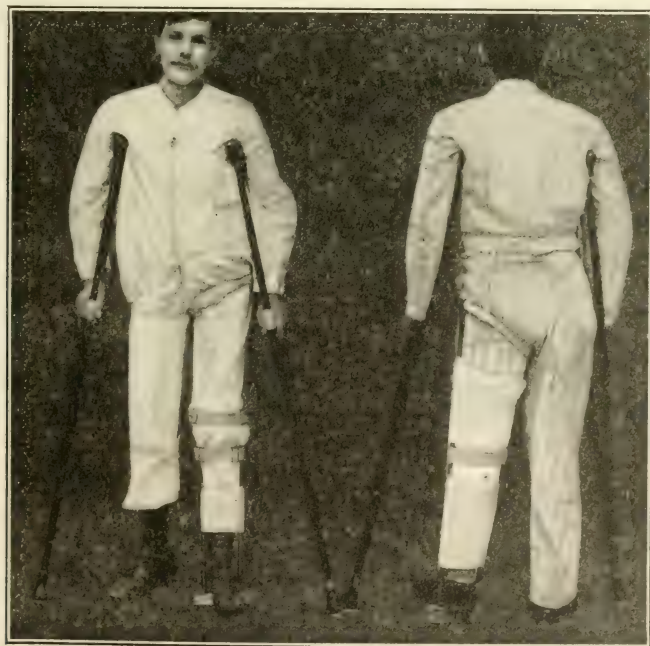
Fig. 52

the ambulatory treatment of fracture of the femur. The union of the
bone is not yet quite firm. Fig. 51 shows the application of the same
splint for an injury of the knee. Fig. 52 pictures the soldier walking on
the Thomas splint.

The principle of this splint is one which I will develop later. I am
impressed that it has the most important application to war surgery.

Fig. 53 illustrates the application of this splint to a severe compound
fracture of the femur. Fig. 54 is another view of the same dressing.

I believe, if one were to study these pictures in detail, the technic
would become quite plain.

Students and surgeons need special training in dressings of this kind.
The average graduate in medicine today has very inferior training with
all types of fixation dressings, and even after one or more years' experi-

ence in an active operating hospital he is not much better prepared. He must have this special training in the orthopedic department.

Fig. 55 shows very well a method for compound fracture of the femur which allows semiflexion. All of the surgeons with whom I have
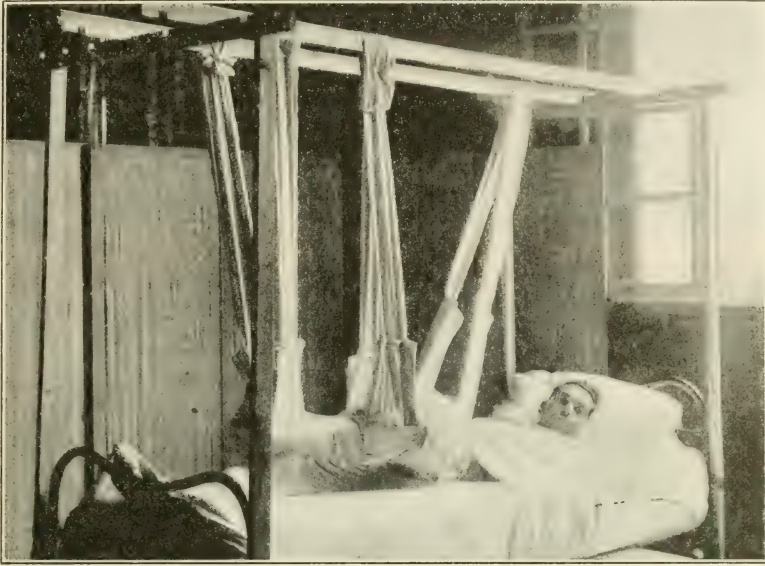
Fig. 55

discussed this point speak of the simplicity and comfort of a fracture dressing of this kind for various types of injuries of the lower extremity from the upper end of the tibia to the hip-joint. The materials in this

Fig. 56

splint can be obtained anywhere, all that is required being boards, pieces of canvas or sheeting, a heavy needle and thread and a safety pin.

Fig. 56 shows how plaster can be employed for an infected compound-fracture wound of the upper femur. This dressing also holds the limb in abduction.

Fig. 57 is a more elaborate method of producing slow but forced extension in contractions of the knee-joint after injury.

FIG. 57

Fig 58 tells one how to bridge a large defect with plaster. Here we see a shell-wound, compound fracture of the lower femur—a wound that probably requires dressing a number of times a day.
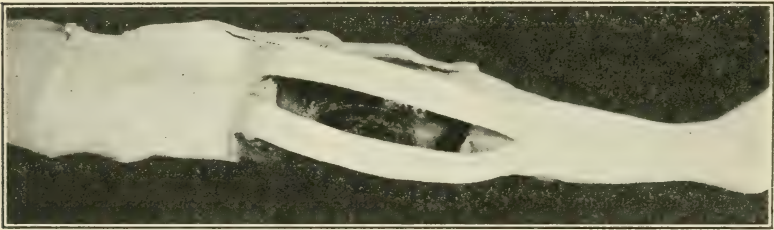
FIG. 58

Fig. 59 shows the bridge for even a larger defect; Fig. 60 a beautiful fracture dressing bridged with steel for a compound fracture of both
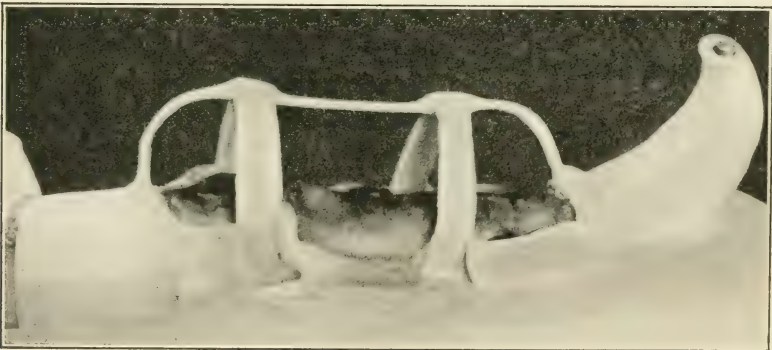
FIG. 59

bones of the leg. Fig. 61 is another method for a compound fracture of both bones of the leg. Fig. 62 is a simple device to prevent con-
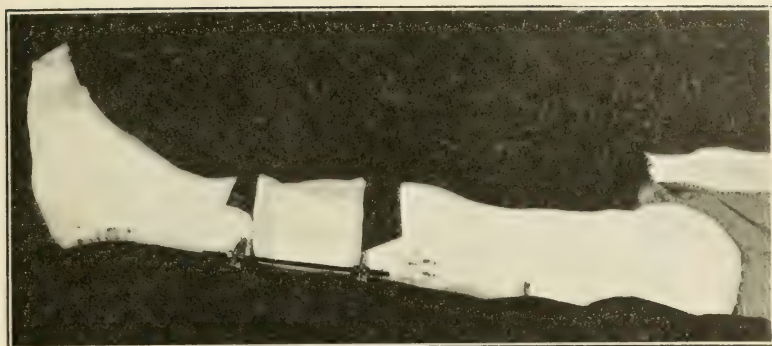
FIG. 60
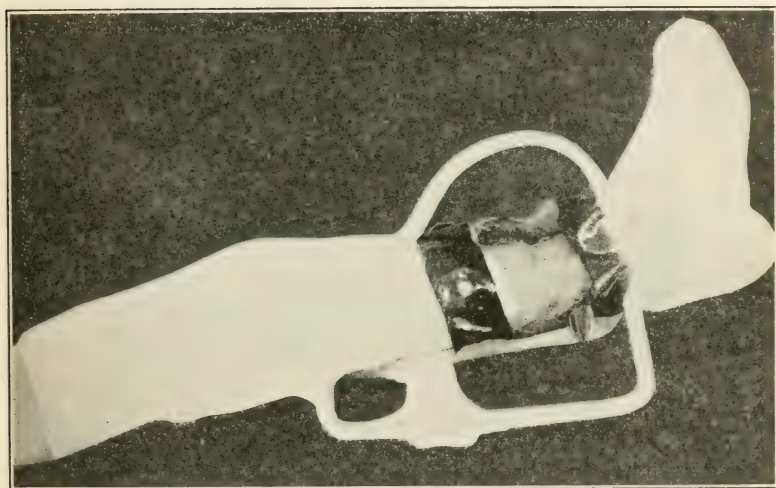
FIG. 61
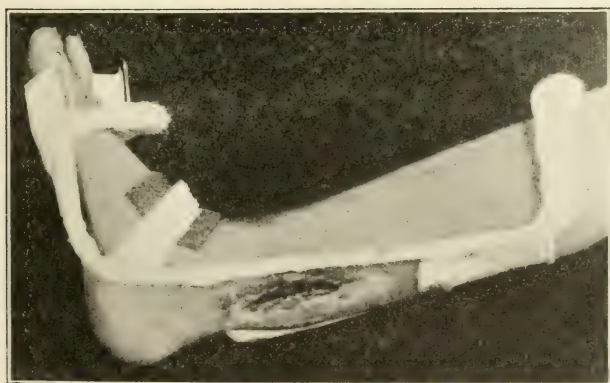
FIG. 62

traction of the tendo Achillis when the wound or fracture is in that
locality, and Fig. 63 a very comfortable-looking device to alleviate
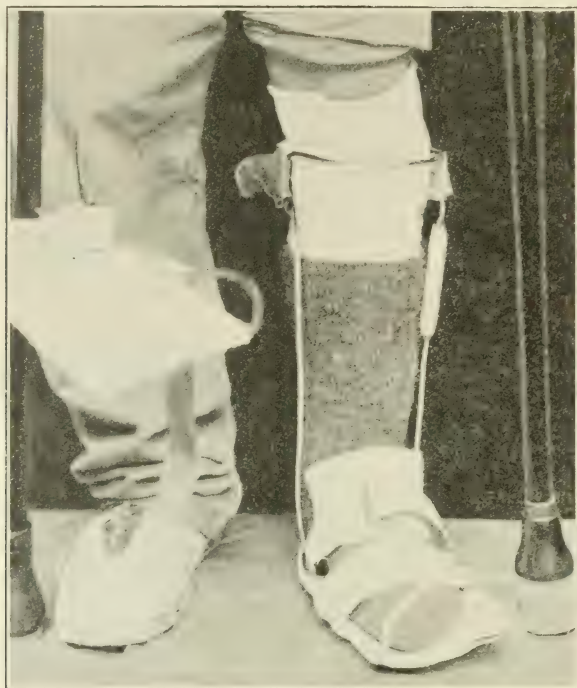
Fig. 63
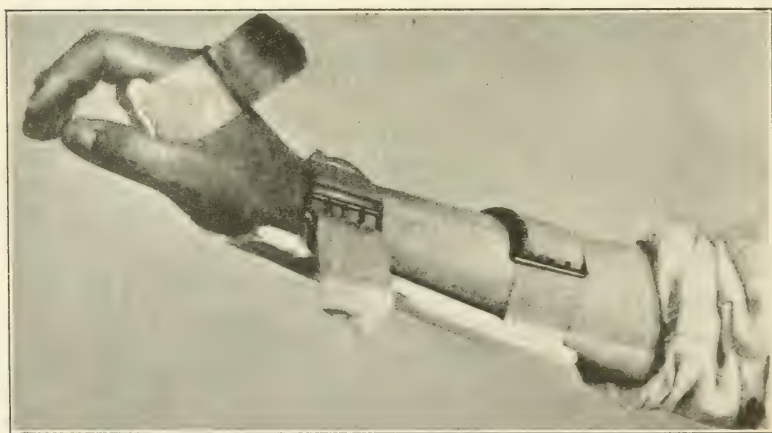
Fig. 64

that annoying toe-drop which is often a complication of fractures and
injuries in the region of the fibula. Every one of these pictures is a
lesson in itself.

Musculospiral paralysis apparently is a very frequent complication of injuries of the upper arm. Fig. 64 shows the apparatus called *cock-up splint* to relieve the discomfort of this drop. Fig. 65 illustrates a compound butterfly fracture of the humerus dressed in the aëroplane splint. I have described, in previous numbers of PROGRESSIVE MEDICINE, the so-called Middledorpf triangular splint. This holds the upper arm
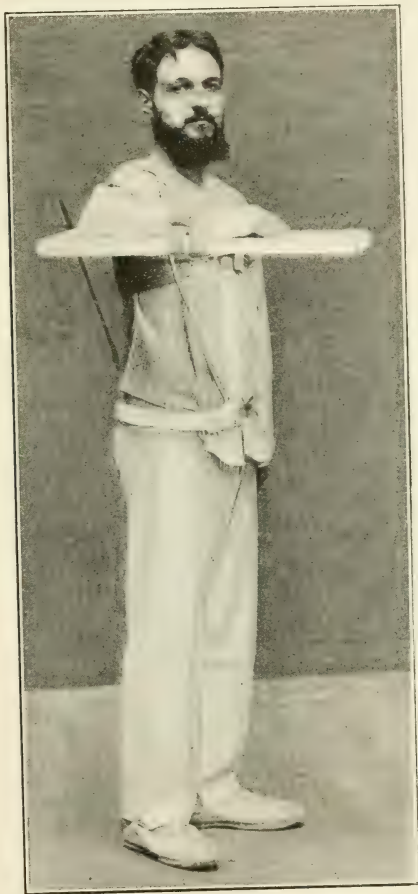
FIG. 65

in abduction and allows extension; but in different fractures, especially compound fractures, with wounds requiring frequent dressing the apparatus needs constant changes to meet the different requirements, and Osgood's pictures illustrate various other types besides this aëroplane splint. In Fig. 65 the forearm is in flexion; in Fig. 66 in extension. In Fig. 67 abduction is the position most needed on account of fracture of the neck of the humerus. In Fig. 68 we see illustrated a plaster

scheme to allow ready and frequent access to a wound in the region of
the elbow-joint.

We know, in civil practice, the dangers and the discomforts of faulty
dressings in simple fractures, we know the increased period of disability
because of lack of knowledge and attention to details. A fracture
improperly treated is always a very costly injury. It takes little imagina-
tion to see the greater difficulties with compound fractures, especially
when complicated with a large, open shell wound. These cases can be
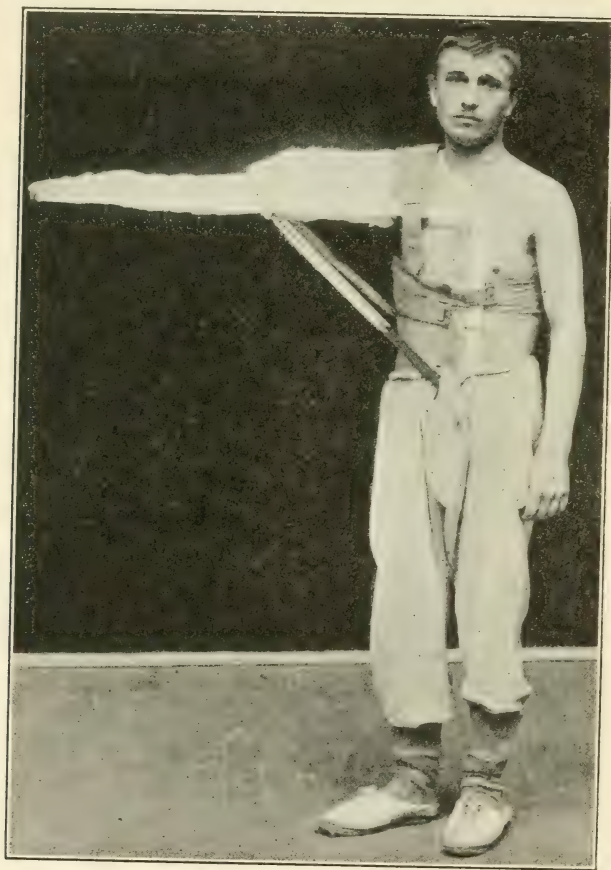
Fig. 66

properly treated, but in the hospitals we must have surgeons whose
civil experience has made them familiar with dressings involving the
same principle. This knowledge puts an added responsibility upon the
orthopedic surgeons of this country. They surely will be essential to
the base hospital.

Corrigan[1] describes and pictures (Fig. 69) an interrupted cast for

[1] Journal of American Medical Association, 1915, lxiv, 585.

compound fracture. The simplicity of the adjustable steel bridge is the part of the scheme that will appeal to those who have had experience in making dressings of this kind.
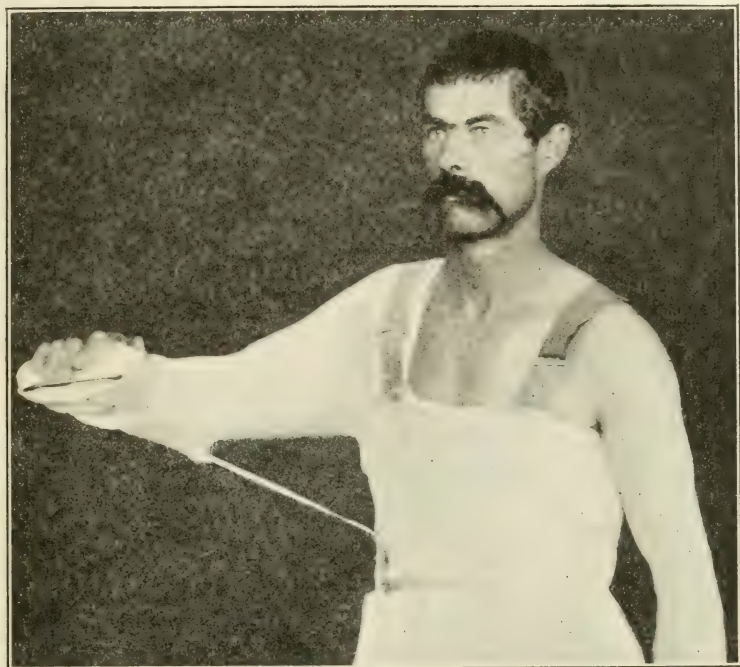
FIG. 67

Von Saar's[1] observations were made in a base hospital in the Balkan war of 1913, and concern chiefly fractures. He gives interesting figures
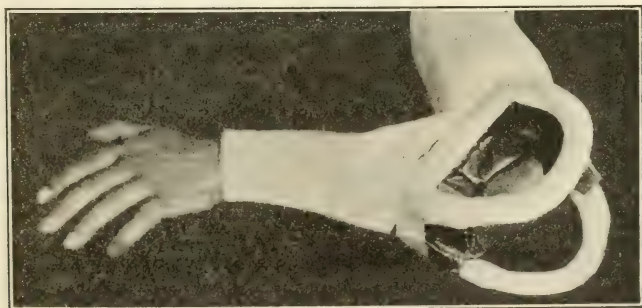
FIG. 68

to show that 74 per cent. of the wounds involve the extremities and about 13 per cent. fractures. They are about equally divided between the upper and lower extremities.

[1] Beitr. z. klin. Chir., 1914, xci, 351.

In speaking of first-aid, he emphasizes dry dressing, no anesthesia, no probing, and immobilization with the simplest apparatus, and careful transportation to the nearest hospital. He objects to the use of plaster. In the first dressing the chief attention should be given to the protection of the wound, there need be no special attempt to put the fragments in perfect apposition. At the base hospital fractures can be treated with modern methods, and good results can be obtained without control by the x-rays. On the whole, he preferred extension methods, in the upper extremity with some form of triangular splint, in fractures of the
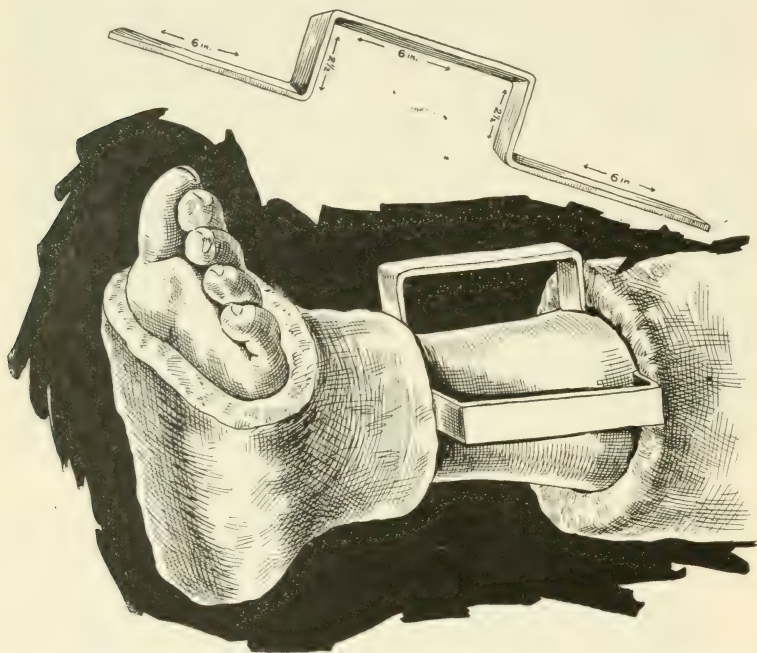
Fig. 69.—Cast for compound fractures, with detail of hoop-iron brace.   (Ohlmacher.)

femur extension in flexion with the leg swung from an overhead pole on the principle of Smith's anterior splint. Fractures of the leg were more often infected than any other fractures, and in those in the lower third the bone more often protruded. He objects to plaster, prefers here some form of shoe extension. If there is infection, abscesses should be opened as they appear.

Different methods are discussed for the different types of fracture.

Col. La Garde comments on this: In transport, nothing takes the place of a fixed dressing, and plaster of Paris is the best material with which to immobolize.

Goebel[1] agrees with von Saar as to the non-interference with these wounds. The wound should be covered at once with a sterile dressing. He differs, however, entirely from von Saar as regards the fixation dressing. He prefers plaster. All other types of dressing will not stand long transportation, but he also employs plaster in the permanent hospital treatment. He is of the opinion that the prognosis in firearm fractures is, on the whole, better than in compound fractures in civil practice. Even if the wounds become infected, the chances of preserving the limb are good. Operations are only indicated when the suppuration continues. Then incision is sufficient with evacuation of the foreign body or dead piece of bone always found. He employs in the upper extremity the Middeldorpf splint, especially in fractures of the upper part of the humerus, where plaster should not be employed. Von Saar is of the opinion that the Middeldorpf splint is uncomfortable. Goebel prefers plaster also for fractures of the thigh. Plaster is used in the first dressing, the area of the wound should be marked on the dressing then, so that at later dressings the new surgeon will know where to make the fenestrum. This opening is indicated when there are signs of infection, but infection does not mean removal of the immobilizing dressing. Infected cases badly immobilized improved after good immobilization. In some instances of infection, it is best to put on two plaster casts with an aluminum bridge over the wound. This simplifies dressing. Amputation is rarely necessary.

Goebel's remarks are rather general, no special cases are given.

Joseph Ballner's[2] contribution is a study of compound fractures of the diaphyses, many of which were infected.

The hospital in which these infected fractures were observed was on the so-called second line under the care of the Austrian Red Cross.

The wounded were mostly Bulgarians injured by the S-bullet of the Turkish troops. They had, therefore, little experience to compare these wounds with the wounds of the Turks inflicted by the Manlicher Bulgarian bullets.

Fractures of the diaphyses are usually comminuted. The comminution increases with the nearness of the range. In the region of the wound of exit the splinters are more numerous and therefore the soft-part wound greater. When infection takes place this is the usual first site, sometimes it is confined to this area only. For this reason, when an operation is indicated, explore through the wound of exit. The splintering may extend some distance from the zone of comminution.

Perforation, with or without splintering, or hole fractures in the shaft are rare. These are usually seen in the epiphyses.

In this second-line hospital the injured were received five to ten days after their wounds had been inflicted. In all the cases the first aid

[1] Beitr. z. klin. Chir., 1914, xci, 373. [2] Ibid., 381.

had been faulty, many had not even been bandaged, in very few had there been fixation of the fracture. In many cases there were decubitus ulcers. The methods of transportation were very bad.

Col. La Garde comments on this: At Santiago the first-aid dressing came loose in a large number of cases; nevertheless flesh wounds healed kindly. Fractures were all infected.

In a few cases the first-aid dressing had been insufficient and had been made too tight; then it became blood-stained, the soaked thin dressing dried and the resultant constriction was associated with gangrene.

Of 116 fractures, in 8 (about 6 per cent.) amputation had to be performed for infection of some kind or gangrene. These infected cases which had to be amputated are distributed as follows:

Femur 37, 4 amputations; leg 26, 2 amputations; humerus 37, 2 amputations; forearm 16, no amputations.

Severe infections requiring amputation were therefore most frequent in the thigh, and least in the leg, absent in the forearm. This surgeon is of the opinion that many of the fractures of the thigh, especially with shrapnel, did not reach the hospital, as they bled to death immediately or on transportation, but he does not furnish definite observations to prove this point.

	Total cases.	Clean.	Infected. No operations.	Infected. Operations.	Infected. Amputations.	Tota
Femur . . .	37	13	5	15	4	24
Leg	26	12	9	3	2	14
Humerus . .	37	22	3	10	2	15
Forearm . .	16	10	1	5	–	6
	116	57	18	33	8	59

Of 116 compound fractures associated with bullet or shrapnel injuries, 59, or over one-half, were infected when observed five or ten days later at the second-line hospital.

Of these, 18 recovered from their infection without any operation; in 33 some operation was necessary. The nature of this operation will be discussed later. In 8 cases amputation was required.

Eight cases is about 13 per cent. of the total infected cases (59).

The results of the operative treatment of 33 cases of infected firearm fractures:

	Total.	Good.	Shorten.	Non-union.
Femur	15	8	5	2
Leg	3	3	–	–
Humerus	10	7	–	3
Forearm	5	5	–	–
	33	23	5	5

This shows that among 33 infected compound fractures there have been 5 cases of non-union; 2 out of 15 in the femur and 2 out of 10 in the humerus.

It seems to me that these tables demonstrate that the method of treatment employed was, on the whole, satisfactory. In 18 cases, in spite of infection, no operation was necessary; in 33 cases only 5 cases had non-union. It would, of course, be interesting to have the details in these cases of non-union. Probably excessive splintering and injury of the soft parts will explain them.

Of course, the cases subjected to amputation were not due to the fault of the treatment after the patients reached this hospital.

There is apparently no question that in this group of cases the first aid—occlusive dressing of the wound—was poor and often absent; the fixation of the fracture faulty in every instance, or absent; the transportation bad. In spite of this, 57 cases of the 116, or one-half, were not infected. It would be interesting to compare these with a similar group properly treated and properly transported.

It would also be interesting to know the details of the 57 non-infected cases; whether it was the diminished severity of the wound, or the better first-aid dressing.

Ballner is of the opinion that the infections were due to secondary contamination rather than primary infection by the projectile, but Col. La Garde thinks that while secondary infection may have taken place, the infection was more than likely the result of dirty skin, shreds of clothing, and the dirt from the bullet.

Gas phlegmons were observed on both the upper and lower extremity. Every case was subjected to immediate amputation. Apparently all recovered.

In my experience, severe gas phlegmons will hardly reach the second-line hospital in five to ten days, at least a number of the patients would die before they got there, so patients with the best resistance only reach these hospitals, because all these amputations recovered.

The infection with the Bacillus coli lengthened the convalescence, but never required amputation. Green-pus infection apparently had no bad effect on eventual healing, but he observed cases with yellow pus, without fever, in which the wound healed very slowly.

This hospital was not equipped with an x-ray apparatus, and there is no note that bacteriological studies were made, so these observations must be taken as clinical.

When these cases of fracture were admitted to the hospital they were immediately properly dressed, and temporary extension and temporary splint applied. If there was no evidence of infection at the time, the patients did well and in a few days were placed in plaster, except the upper-arm cases. This then became the aseptic or clean group. The average time of fixation was about four weeks in the upper and six weeks in the lower extremity.

In the cases with signs of infection, local and general, the same fixation methods were employed. In 17 cases this rest and fixation were followed

by a disappearance of the local and general infection. Then the cases were treated as the previous clean group. However, if after a few days of such treatment the local and general signs of sepsis did not disappear, operation was considered indicated and performed (in 33 cases). The operation consisted of incision over the wound of exit, evacuation of pus, removal of absolutely free splinters, or opening of pus pockets. The operator preferred small incisions at a point best for the mechanical drainage; fragments attached by periosteum or detached but covered with periosteum were not removed, but pushed into position. Resection of the ends of the bone was not performed—this always increases shortening and the danger of non-union.

The operator found plaster dressing with a fenestrum to allow the frequent cleansing of the suppurating wound the best method of fixation. In the upper arm it is employed in the shape of a Middledorpf triangle. In fractures of the thigh, the plaster extended to the knee only, in the shape of so-called plaster trousers. Col. La Garde here suggests that to avoid pain in transport the knee and ankle should be included in the immobilization.

Extension was found to be difficult, and any splint dressing which had to be changed every time the wound was cleansed added discomfort to the patient and difficulties to the surgeon.

I get the impression from this review that plaster dressing is the best available means for infected compound fracture in war surgery, and Col. La Garde agrees with me.

After this conservative operation, one should not expect an immediate fall of temperature for a few days, and also there will be a temporary increase of the wound discharge.

This article should be read by every civil surgeon, because our experience in infected compound fractures is very limited, and few surgeons realize that infection in a compound fracture may not interfere with a perfect result. The period of disability is usually two or three weeks longer than when there is no infection.

Nail Extension in Compound Fracture of the Femur. I look upon the contribution of Hohmeier[1] as the most interesting and most important experience in this war with compound fracture of the femur. The results in simple fracture are difficult enough to get, but to read of this surgeon's results in infected compound fractures increases one's respect for extension, passive motion, massage, and careful attention to wound treatment.

In this base hospital at Marburg they have had 24 cases of compound fractures of the femur. In 18 nail extension was employed. In 12 instances the nail went through the lower end of the tibia, in 6 through the os calcis. But, from his experience, he recommends the os calcis.

[1] Beitr. z. klin. Chir., 1915, xcvi, 255.

He does not recommend nail extension for all fractures in which extension is indicated, but for infected compound fractures.

This extension referred to the ankle leaves the entire field free for the treatment of the wound which requires treatment often four and five times a day. The patient can even be immersed in a temporary bath without interrupting nail extension, but provision must be made to keep the ankle out of the water contaminated by the wound secretion. The only three infections about the nail observed by them followed immersion of the ankle in the water. This took place before arrangements to obviate this had been perfected.
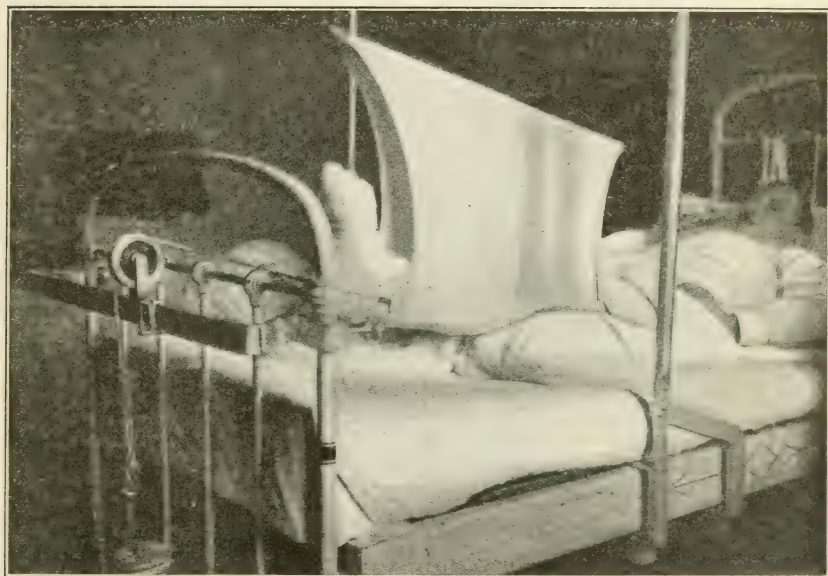
Fig. 70

The patients with infected compound fractures not only must have a wound dressing at frequent intervals, but they require more attention to the joints and muscles. The patient, by pulling against the weight in his swing, can give active motion to joints and muscles which cannot be done in plaster.

By increasing the weight and checking with the *x*-rays, the surgeon knows when the fragments which previously overlapped are drawn apart; the weight then can be decreased until they are in proper apposition. The extension on the fragments, even up to the point of slightly drawing them apart, Hohmeier has observed, exerts a favorable influence on the suppurative process. In three of his cases the condition of the wound was not favorable until extension had accomplished this separation.

In these cases, in spite of suppuration, there were no non-unions, in the majority of cases little, or no, shortening; even in the cases with comminuted fracture with many fragments, in which some of the fragments were discharged as sequestra, there was bony union; in some
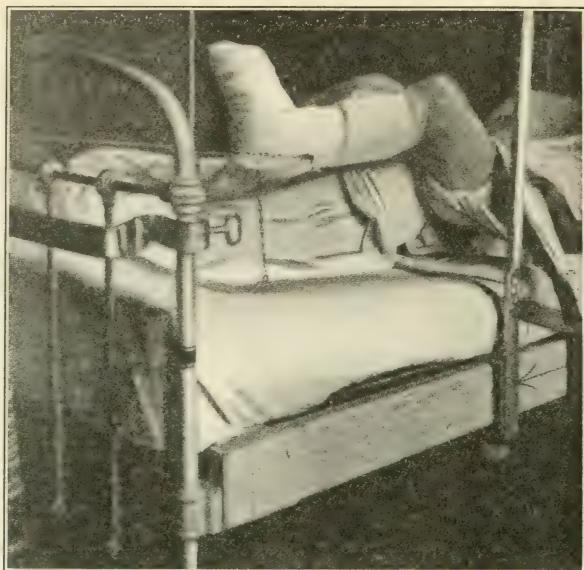
FIG. 71

cases, quite naturally, with some deformity. This is a remarkable series—no amputations, no pseudarthroses!

Fig. 70 illustrates the complete dressing: The extended leg is swung in a piece of canvas; the thigh may rest on a pillow. Fig. 71 illustrates how the patient can lift or pull against the pulley weight and give him-
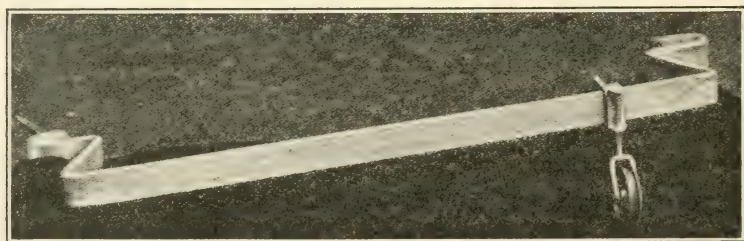
FIG. 72

self active motion in the joint. Fig. 72 is the simple bar which is attached to the end of the bed. This has the advantage that it gives the pulley a wide lateral range, at the same time keeping it away from the foot of the bed. This is most important, as it allows changes in the position

of the patient, not only for his general comfort, but also for local conditions. Fig. 73 represents the arrangement of the nail with the chain attachment to the pulley. The principle is shown in this picture. The nail must be long enough to project beyond an ordinary dressing so that the two little tubes carrying the chain can be just fitted over it on each side.

This extension apparatus can be put on with very little discomfort to the patient and kept on until the overlapping is overcome by the extension, until the suppurating wound is about closed. Then the patient can be put up in a plaster dressing, but this dressing should be applied with the nail extension in position, and not removed until the
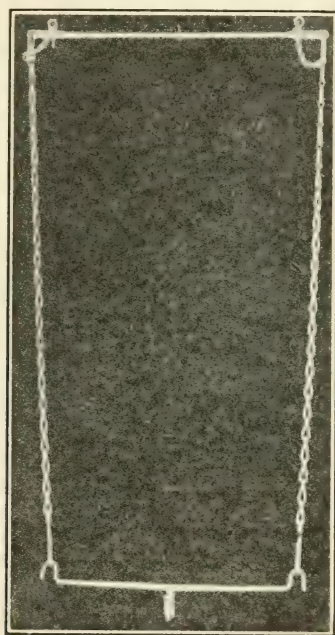
Fig. 73

plaster is solid. Then the patient may be allowed to get up on crutches. The average period of such extension is over three weeks. In only 3 of their 18 cases which I have already mentioned did they have to remove the nail on account of infection. They removed it on the first signs of redness and secretion, and there was no further consequence. The nail, therefore, in 15 cases gave absolutely no discomfort and did no harm.

This form of extension is much simpler to maintain than that with adhesive straps in cases of this kind. Hohmeier emphasizes again and again the importance of checking the weight by repeated x-rays; the patient with limb in extension is wheeled on his bed to the x-ray room.

Not only must the suppurating wound be dressed frequently, but there must be constant attention to the general condition of the limb; the coöperation of the patient must be obtained for active and passive motion of the joints and for voluntary motion of muscles and massage. One can see at once that this treatment requires greater supervision than a plaster dressing with fenestrum. We cannot expect in a plaster dressing any improvement in the position of the fragments after the plaster is applied, except by repeated changes in the plaster dressing. This would therefore mean that before the plaster dressing is put on, if one wished to correct the deformity of a fracture, there would have to be forced and violent extension which, experience teaches, should not be applied to an infected compound fracture. It would therefore appear to me that this extension method should give better results as far as the position of the fragments. There is no question that plaster is not as good for the function of the joint and muscles as extension.

I trust from later communications to be able to compare the results in compound fractures of the femur obtained by these two methods of treatment—extension and plaster.

Aside from this unusual and instructive experience with compound fracture of the femur, the article has added interest in a description of how these injured soldiers reach the base hospital. In 3 cases only the immobilization was proper; these 3 cases had on their first-aid sterile dressings and broad lateral splints extending from the foot to above the pelvis. It is remarkable to note that in these 3 cases there was practically no infection of the wound. Every other case suppurated. In these there was either no fixation dressing at all, or it was badly applied. Now, one can feel that in this group the absence of a proper dressing may have been due to force of circumstances, but some of the patients came to Hohmeier's base hospital in plaster with the statement written on the diagnostic tag that the dressings need not be changed for three weeks. In every instance the immediate removal of the plaster dressing by Hohmeier was the first step in saving the patient's life and limb.

The remarkable thing about these infected cases is that they got well. Here are 21 cases whose first aid was absent or faulty, whose fixation was neglected, insufficient, or worse than none, bad plaster. We are told that the wounds were filled with stinking pus; the patients had fever. Yet, in a modern hospital they are put to bed, bathed, wounds are cleansed; wounds, if necessary, enlarged for better drainage, and then there follows a definite plan of treatment which has in mind not only the combating of the infection of the wound, but at the same time the restoration of the continuity of the comminuted bone and the accomplishment of bony union. One can easily imagine the care these 24 cases of extension would give, the careful watching of the weight, the

frequent dressings, and now and then the more difficult immersion in a bath. I look upon a surgical treatment of this kind as a far greater achievement than some brilliant operative results, such as the resection of the stomach, or the wiring or plating of a fracture. A surgical treatment of this kind is a continuous sustained effort for weeks, and the one in charge must supervise all the details.

It is a method of treatment in which I find the greatest difficulty to interest the average American surgeon, or the average American surgical intern in a hospital. Extension has its definite place in the treatment of fractures.

Operative Treatment of Compound Fractures. Lexer,[1] in his almost monographic article, lays special stress on the importance of preserving the periosteum, and advocates the use of bone grafts rather than buried plates and screws. When some material is needed to hold the fragments, he prefers aluminum-bronze wire.

In compound fractures, one should wait until the wound has almost healed and all signs of infection have disappeared. If there are a few granulating areas, these can be excised, to be followed by redisinfection and change of instruments.

In previous numbers of Progressive Medicine, I have fully reported Lexer's work on the circulation in bones, so that he must be looked upon as one of the best authorities on this point. He claims that his investigations have shown that the chief source of blood supply to the periosteum comes from the soft parts and not from the bone, so that in all operations upon bone one should preserve the attachment of the periosteum to the soft parts. It is apparently safer, therefore, to strip the periosteum from the bone when one must expose the ends of the fracture, rather than strip the bone with its periosteal cover from the soft parts. Apparently this is a principle well established in surgery—subperiosteal resection and subperiosteal exposure for fracture. Yet, in recent times surgeons have not followed this rule sufficiently closely. In order to get good exposure, they have detached the periosteum from the surrounding soft parts. This may explain some of the failures in the operative treatment of fractures.

Second, in operating on all fractures in which there has been an inflammatory process, Lexer is of the opinion that all the scar tissue in the region of the fracture should be excised. The object of this is to improve the circulation where it is needed most, that is, in the region of the fracture.

Lexer expresses the opinion that all non-operative measures which have been recommended to hasten bony union are contra-indicated, because they increase this scar tissue about the fracture. These measures are injections of irritants and blood, and drilling through the fracture.

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[1] Deutsche Zeitschr. f. Chir., 1915, cxxxiii, 170.

If these measures fail, the operative measure which must follow is rendered more difficult.

When the wound is clean, or when there is no wound with the fracture, the surgeon can select his time for operation. Lexer seems to voice the opinion of the majority when he states that it is best to wait at least one week. This gives an opportunity for the swelling due to the trauma to subside and for collateral circulation to establish itself. At this time there is little, or no, new connective-tissue formation. After this period, the longer one waits, the greater the difficulties of the operation, due to the condensation of the granulation tissue into fibrous tissue and the formation of callus.

Lexer is of the opinion that when the nature of the fracture allows one to reduce the fragments and fix them with their own indentations, nothing more should be done. In a second group, indentations of the step-ladder variety may be made. When this method of fixation of
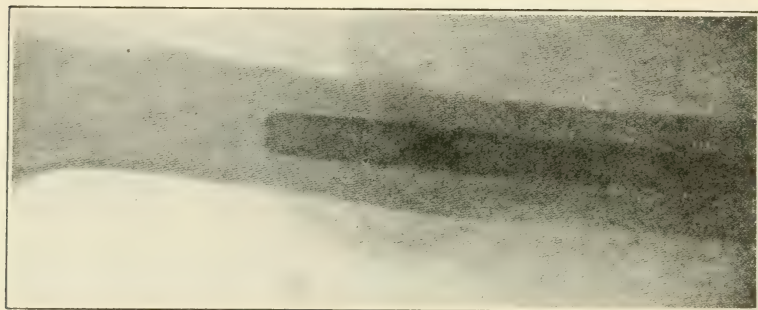
Fig. 74

the approximated fragments is impossible, or seems insufficient, the fragments—two, or comminuted—should be fixed by a bone graft, autogenous, if possible. The central bone-graft pin is the most important, but in many instances one must, in addition or alone, use bone grafts as lateral splints. The lateral bone-graft splints, of course, must be fixed with wire. As stated before, Lexer does not employ buried screws and plates.

Fig. 74 is an x-ray of fracture of the lower shaft of the femur fixed by a marrow bolt of transplanted bone only. Fig. 75 shows the method of holding the lateral splint of a bone graft.

Lexer goes into considerable details in regard to the bone graft: It should have periosteum; it should fit its bed snugly; it is his opinion that the granulation tissue which forms in dead spaces about the bone graft is responsible for osteoporosis and fracture of the graft; the snug approximation of the tissue, bone and soft parts about the graft, not only prevents hematomas in cavities, but the closer approximation of

the vascular tissue rapidly vascularizes the bone graft. It is these details that make bone grafting difficult.

I am not willing to accept Lexer's sweeping statement in regard to buried screws and plates. As far as I know, Halsted, in 1893, was the first to bury screws with the Hansemann plate, and my experience with this has been uniformly successful in properly selected cases. For fresh fractures, when there is no scar tissue and good circulation, the plating is simpler than the bone grafting and should be successful. In old fractures, with much connective tissue and callus about the fragments, and in fractures with non-union, the bone graft seems to promise success in a larger percentage of cases than the plate and buried screws,
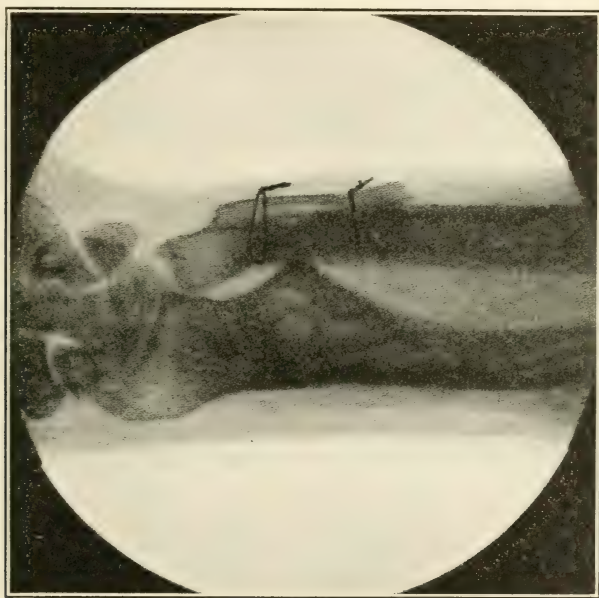
FIG. 75

because in these cases we need more bone than can be furnished by the bones in the region of the fracture. The purpose of this bone graft is not only to make a bridge of bone, but to stimulate the end of the fracture to form bone. The bone graft is a better marrow bolt than any foreign material.

Compound Fracture. Osteomyelitis. In view of the great number of gun-shot fractures in this war, contributions dealing with improved methods of treatment of osteomyelitis are needed. I find an excellent one by M. B. Clopton,[1] of St. Louis. It is based on an experience of 31 cases in four years. Clopton concludes that the essential features

[1] Surgery, Gynecology and Obstetrics, 1915, xx, 6.

in treatment are as follows: In the acute stage chisel a narrow channel of bone along one side of the affected shaft as you would canoe a tree trunk, but never curette the marrow cavity, simply drain it with gutta-percha tissue; do not pack it with gauze. He says nothing in this paragraph about the employment of antiseptics. Even the infected marrow tissue of acute osteomyelitis still has living endosteal cells of great value in the later healing and filling of the bone defect.

In the subacute and chronic stage the same principles of drainage are employed; sequestra should be removed, but the cavity should not be curetted or sterilized with antiseptics. Gauze should never be employed as drainage. These cavities in the subacute and chronic stage should be filled with an iodoform-beeswax plug of Mosetig-Moorhof.

When a single bone of the leg or forearm is extensively involved, Nichols' method of subperiosteal resection can be followed after the inflammatory process has sufficiently subsided from the proper drainage. The choice of time for this operation is well indicated in the x-ray, as the bone activity of the periosteum is clearly pictured. When bone regeneration is not sufficiently complete, bone transplantation can be secondarily employed.

I can agree with Clopton most emphatically in favor of drainage, against curetting, and against packing with gauze. I have been unable to see any harm in antiseptics and have always employed pure carbolic followed by alcohol.

I have had no experience with iodoform-beeswax, but I have always employed some form of ointment dressing. The object of this is to keep any gauze from sticking to the granulation tissue.

In addition, I am inclined to think, it is frequent dressing and careful attention to small detail which improve the results in the treatment of osteomyelitis, especially the chronic cases. In both the acute and chronic stage the essential feature is drainage, with the least amount of bone destruction. Extensive chiselling of living bone is contra-indicated. When we feel we must do more, then we must go to the other extreme of complete subperiosteal removal. This is rarely indicated, except in a few acute cases, and rarely successful in the very chronic cases with much involucrum. This operation of Nichols has a distinct place when we are not given an opportunity to operate in the acute stage, but when we see the patient before the chronic stage of multiple sinuses, sequestra, and involucra.

WOUNDS OF VESSELS AND ANEURYSMS. Rehn[1] either has not seen many of these injuries, or has not had time to write about them in his letter. One should be on the lookout for vessel injury in all cases, and for the development of an aneurysm later. Rehn remarks that in the

[1] Loc. cit.

first-dressing station, and especially in the division and base hospitals, extremity injuries, with or without swelling, should be auscultated. In this way one will hear one of the earliest signs of aneurysm. As a rule, in injuries of bloodvessels the bleeding is more apt to be secondary than primary, so that at the first-dressing station, or at the division hospital, the vessels should be exposed and ligated. These cases should not be transported to the base hospital until they are protected.

The most frequent cause, however, of secondary hemorrhage is infection of injured vessels.

Kotschetoff[1] gives an idea of the relative infrequency of bloodvessel injury. Of 576 men wounded by pointed bullets, there were 629 wounds, in which bloodvessel injuries were observed in 11 cases; this is less than 2 per cent.

In PROGRESSIVE MEDICINE for December, 1914, I reviewed some very important literature on military surgery, based upon experience of the Russo-Japanese, and especially the recent Balkan wars. When this review was being written, the present war had no literature. I devoted almost fourteen pages to a number of splendid articles.

The experience with aneurysms is of especial importance, and every surgeon at the front today should be familiar with these papers. We may summarize the conclusions in which apparently all authors concurred: Wounds of upper and lower extremities should always be immobilized whether there be signs of fracture or not; this immobilization is the best protection from secondary hemorrhage in bloodvessel injury; it always modifies the size of the hematoma and in some cases they may be healing without aneurysm. If there is proper immobilization, these cases can be easily transported to the base hospital. As the aneurysms are most frequently in bullet wounds without fracture, the patients are usually in good condition and can be transported. An aneurysm should be looked for in all these wounds of the extremities. Pulsation may not appear for some time. In the majority of cases, it is not an operation of emergency. It can therefore be done under the best environment.

One should prepare for vessel suture or transportation, but this as a rule is unnecessary. Expose the palpable and pulsating sac under the protection of an Esmarch, turn out the blood clot; ligate the upper portion of the injured vessel, put a temporary clamp on the lower end; now loosen the Esmarch, and if the lower end bleeds when the clamp is removed, reclamp and ligate; if it does not, transplant a vein into the defect.

Fritz Loetsch's[2] experience is based on his observations in the first Balkan war. This article has only recently been reviewed in American

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[1] Surgery, Gynecology and Obstetrics, 1915, xx; 171; abstr.
[2] PROGRESSIVE MEDICINE, December, 1914, p. 233.

surgical journals.[1]   Aneurysms, like infected wounds, are rare in civil practice, but fortunately there is much in the literature which will be helpful to the civil surgeon to meet this new requirement of war surgery.   So far, we have heard little about aneurysms in this war. It may be due to the fact that the shell wounds predominate.

It is very interesting that in these days of vessel suture it has been applied to only a few cases, and that this new experience has shown that the oldest method of treating an aneurysm is still the best method.
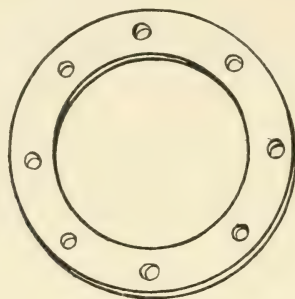
Fig. 76

In Progressive Medicine for December, 1914 (p. 236), I reviewed the method of vessel suture by Jeger and Unger in which they employed the prothesis method of Payr, using thin, absorbable, magnesium rings perforated with eight holes (Figs. 76, 77, and 78.)

This article was published in 1913.   In 1914 E. Jeger[2] was able to report 8 cases of suture of bloodvessel injury acquired in Przemys in the present war.
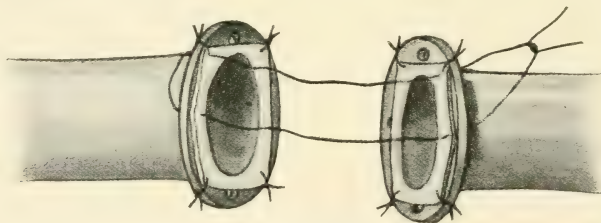
Fig. 77

It is to be recollected that the majority of authorities seem to agree that vessel suture is seldom indicated.   If the limb is immobilized, the patient can be transported to the base hospital; the best time for operation is about the third week; then collateral circulation seems well developed and at its best; later, the enlargement of the aneurysmal sac interferes with collateral circulation.   At this time the operation

[1] Surgery, Gynecology and Obstetrics, 1915, xx, 59; abstr.

[2] Berl. klin. Wchnschr., 1914, li, 1907; reviewed in Surgery, Gynecology and Obstetrics, 1915, xx, Abstr., 396.

of double ligation of the vessels above and below the sac or injury is usually sufficient. Yet, Jeger is of the opinion that, in 6 out of his 8 cases, ligation would undoubtedly have been followed by gangrene. His cases of suture were as follows: One popliteal artery and vein; one popliteal artery; two femoral arteries; one femoral vein; one axillary artery. It is these 6 cases in which in his opinion that ligation would not have been successful; 5 of these cases were apparently successful after suture; in 1 case it was necessary to do a secondary amputation for other injuries.

We must remember that Jeger had prepared himself for vessel suture. Every civil surgeon who wishes to practice suture of the bloodvessels must first learn it in the laboratory.
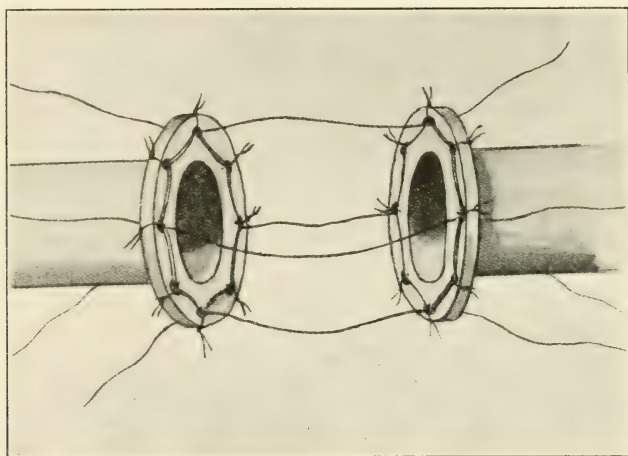
Fig. 78

According to another review of this article of Jeger[1] the manuscript was carried from the fortress of Przemysl over the heads of the besieging Russians to the publisher in an aëroplane, by *Fliegerpost* (flying mail). Of course, in a fortress the wounded can probably be transported to the base hospital as rapidly as in civil practice. So Jeger got his cases early, and it is quite possible that he operated on cases which might never have reached the base hospital under other circumstances, except with gangrene of the extremity; in fact one of his cases first seen two hours after the injury had signs of beginning gangrene then; surely this case would not have developed an aneurysm. Jeger has apparently demonstrated that vessel suture may have its place in the early hours after the injury of bloodvessels. He is not speaking so much of the treatment of aneurysms, as of vessel injury immediately after its in-

[1] Journal of American Medical Association, 1915, lxiv, 472.

fliction. When death is threatened either from hemorrhage, or gangrene of the extremity is impending from impaired circulation, of course, in this early stage double ligation is out of the question. If operation is urgently indicated, vessel suture must be the operation of choice. But in the cases which I reviewed last year, those that reach the base hospital, there had been no threatening hemorrhage, no signs of gangrene, but a silent hematoma; later pulsation, or an arteriovenous communication with the characteristic bruit, and collateral circulation had time to establish itself.

August Bier[1] contributes his article on aneurysms from wounds in war in January, 1915—a base hospital experience in Berlin. He has had 44 cases in less than two months. There was no true sac, but a wall of blood clot, muscle, and fascia. Through this there was still a canal with circulating blood. In some of these patients there was little functional disturbance, except fatigue, in others severe pain with swelling of the limb and contraction. All 44 cases were operated on with excellent results. In a few, hemorrhage and infection urged operation. In the majority of cases, after turning out the blood clot, the blood in the limb was expelled with a Martin rubber band down to the point of injury in the artery. As a rule, there was a single opening which could be sutured. It was also important to ligate the most minute bleeding-points of the collateral circulation. In only a few cases was double ligation indicated. Now, we know that the suture of a large hole in the artery may have exactly the same effect as double ligation, because thrombosis immediately takes place.

Bier's experience, of course, is unusual in the number of cases—44 in two months, in the early stage of the disease—the earliest case eight days, the oldest three months; in certain gross appearances probably never seen before. As just stated, there was rarely a definite sac, but, first, a channel through which blood circulated, and surrounded by blood clot in different stages of organization up to membrane formation; then the tissues which had been separated by the hemorrhage—fascia and muscle thickened and condensed by inflammatory exudate. The injured artery itself was present in a portion of the wall imbedded in inflammatory tissue, but, outside of this, the arterial wall proper remained distinct from the blood clot and its forming sac. If no Esmarch was used in the operation, there was always bleeding from this hole in the artery. If the artery had been clamped above and below the clot, the bleeding was less, but there was still bleeding. Bier looks upon this as a positive indication of collateral circulation, confirming the observation which I recorded last year. Another interesting and apparently new observation was the extensive dissection and separation between the surrounding muscles even to the bone, associated in some

[1] Deutsche med. Wchnschr., January 21, 1915; Journal of American Medical Association, 1915, lxiv, 863.

cases with separation of the periosteum from the bone. The latter was also observed in aseptic cases, demonstrating that it was due to trauma and not infection.

He describes the separation of the periosteum in the femur and in the bones of the forearm. The size of the arterial aneurysm was always larger than that of the arteriovenous and produced more functional disturbances.

Bier states that even when there was no distinct sac, there was not much difficulty in dissecting out the partially organized blood clot and, as I have just written, isolating the main injured vessel, seeing and clamping the bleeding collateral vessels.

Bier then demonstrated some colored pictures made at the operation during the different stages of the dissection. In one picture is seen the dissected out sac of an aneurysm of the external carotid artery, and in a second how this blood collection had dissected up beneath the lower jaw and produced partial ankylosis, which was relieved later by the operation. The sac of this carotid aneurysm had a distinct membranous lining.

Then there was a remarkable picture of a huge aneurysm of the subclavian artery which had been dissected out from below the clavicle; it did not have a membraneous lining as that of the external carotid artery.

Then there were demonstrated pictures showing the actual injury of the arterial wall. There is one of the radial artery but 2 mm. in length, slightly oblique; yet, in spite of this minute opening there was a huge blood clot; a picture of a lentil-sized hole in the deep femoral artery; this bullet had also shattered the sciatic nerve; the blood clot cavity and its intermuscular recesses are unusually large. Then there is the picture of a slit 2 cm. in length in the subclavian artery; this wound was made by a rifle bullet, and, as Bier remarks, looked as if made with a knife.

The injuries in these 4 cases could be closed by lateral suture and there was no thrombosis of the artery.

When one reads the description of these pictures, it requires no imagination to conclude that the incision made by Bier was large, well exposing the blood clot, allowing clamping of the artery above and below the injury and ligating carefully all collateral branches.

In another picture we see a femoral artery and vein completely severed, the ends separated at least 4 cm.; the vein is thrombosed, the artery is not; the dissecting sac is huge. In this case Bier resected the torn ends of the artery and sutured a piece of femoral vein into the defect. He does not mention what was done with the vein; it was probably ligated, but, as the vein was thrombosed, restoring its continuity would be of no value.

Then Bier shows pictures of perforated wounds of an artery—two

opposite holes, two sacs. He remarks that it is difficult to imagine how a bullet of larger size than the artery can perforate it without complete separation. In cases of this kind the portion of the artery containing the two holes is resected and end-to-end suture is performed.

We may be able to reproduce Bier's pictures next year. They apparently represent a rather unique observation, but I reproduce here four little diagrams taken from the article of Otto R. von Frisch.[1] The knife-like cuts and slits, however, are not shown by von Frisch (Fig. 79).

Arteriovenous Aneurysms. Bier shows pictures of his operative dissections of this type of aneurysms. The most frequently observed type is the one in which there is a fistula between the artery and vein, with dilatation of the vein; this dilatation varies. In one example in which the aneurysm was between the internal carotid artery and internal jugular vein, the vein at the point of the fistula showed hour-glass

a   *b*
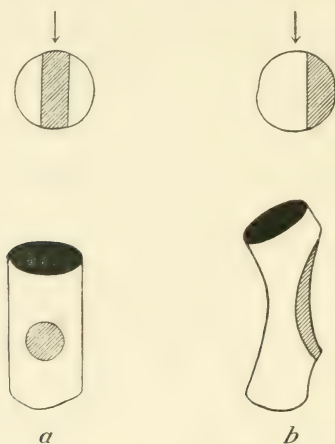
Fig. 79

contraction, while it was but slightly dilated above and below. On the other hand, in a similar case between the popliteal vessels, the vein and its branches were hugely dilated. In the former instance all that was necessary was to divide the communication and suture the holes in both vessels; in the latter instance, on account of the larger opening between the vessels, double resection of artery and vein was indicated, with end-to-end suture. In this type, usually called aneurysmal varix, there is no blood-clot cavity, but a sac, varying in size, between the vessels filled with fluid blood. In the less frequent type of varicose aneurysm, there was no doubt as to the communication from the humming noise. There was a blood-clot mass between the artery and vein, and, when removed, the artery bled. He does not mention bleeding of the vein.

[1] Beitr. z. klin. Chir., 1914, xci, 189.

The aneurysm which I have just noted as shown in one of his pictures, due to the double complete tear of both femoral vessels with thrombosis of the vein, is classed by Bier as an arteriovenous aneurysm, but not of the typical humming kind.

Then there is another type of arteriovenous aneurysm—the artery is perforated, but instead of two lateral aneurysmal sacs, there is one, while the second opening communicates with a vein. In this type there is the pulsation and the bruit of the aneurysm and the venous hum of the arteriovenous communication. The size and shape of the openings in the artery in the arteriovenous aneurysm differ as in the arterial aneurysm. The vein may have an hour-glass contraction at the fistula, or it may be dilated. In one arteriovenous aneurysm of the external iliac vessels, the wall showed calcification. The combination of arterial and arteriovenous aneurysms is not infrequent. Bier pictures one of the brachial and one of the popliteal vessels.

The distribution and character of Bier's 44 cases is as follows:

	Arterial.	Arteriovenous.
Iliac artery	1	
Femoral artery	3	7
Deep femoral	2	–
Popliteal artery	2	2
Anterior tibial	2	
Subclavian below	2	5
Axillary artery	1	1
Brachial	2	1
Cubital	1	
Radial	1	
Ulnar	1	
External carotid	2	
Internal carotid	2	1
Temporal	3	1
Occipital	1	

Differential Diagnosis. Bier calls attention to the classical mistake of an aneurysm for an abscess. In all aneurysms there is traumatic inflammation, giving local signs suggesting an abscess. When the aneurysmal sac is infected, the differential diagnosis might be more difficult. Bier, however, has apparently not made such a mistake. In time of war, when aneurysm is so frequent, this possibility should be constantly borne in mind. In civil practice one should always think of an aneurysm when the apparent abscess followed some form of a perforating wound. Careful examination, however, should differentiate the lesions.

In a second group even the most careful examination may not reveal the true signs of aneurysm—pulsation and bruit, hum. Bier records a case in which he examined most carefully a wound in the region of the buttocks, in which there was blood extravasation, and could find

nothing. Later, the soldier returned with a huge arteriovenous aneurysm which apparently originated within the pelvis, and now the pulsating tumor could be felt externally, as well as *per rectum*.

The nerve complications due to pressure from the bloot clot or aneurysmal sac rapidly subside after operation, but those due to severing of the nerves require their own treatment.

Secondary hemorrhage and infection, if promptly attended to, are not serious complications; infection may modify the operative technic, because at the present time the surgeon hesitates to suture or transplant in the presence of infection. Personally, I can see no harm in a lateral suture in the presence of infection.

Bier's experience in operative treatment favors the direct exposure of the artery, and, if possible, suture or transplantation. Ligation should be restricted to smaller vessels and when the more modern methods cannot be applied to the larger vessels.

His remarks impress me as of sufficient importance to render them here in full.

"Fourteen aneurysms were treated with ligation and excision of the injured piece of artery, two intrathoracic aneurysms of the subclavian artery were treated with ligation above and below the sac and packing of the latter.

"I consider the operations involving ligation of the arteries so rarely indicated these days, that they require excuse and explanation: In 10 instances I was dealing with small arteries (4 temporal arteries, 2 anterior tibial, 3 ulnar, 1 occipital, from the ligation of which no disturbances of the circulation were to be expected. In addition, in several cases the cavities were so seriously infected that suture because of danger of later hemorrhage from the sutured area, was, to say the least, rather risky. In one of the cases treated with ligation, the radial and ulnar arteries were injured close to their origin from the cubital; here the ulnar was ligated, the radial sutured.

"One external carotid artery became so stenosed by the suture of a lateral defect that a temporary catgut stirrup placed centrally from the injury was utilized as a ligature. Here, too, there appeared to be no danger to the circulation.

"In a cubital artery that had been severed by the bullet, both stumps in the blood cavity had contracted so much that sufficient collateral circulation was assured, and both ends were therefore closed by suture.

"The blind suturing of severed arteries and veins has been very serviceable to me. It is especially indicated when the vessel ends are imbedded in scar tissue; one then saves the painstaking dissection necessary for ligation. This method, however, may only be employed when conditions are aseptic. When this is not the case, it may be superadded to ligation, in order to strengthen vessel closure by ligation which is also not always reliable in septic suppuration.

"None of these cases showed any injurious or annoying complications on the part of the circulation. In ligation, our procedure was not to do 'extirpation of the sac' with the removal of large portions of the artery, but to expose the hole in the artery and ligate close above and below it. Thus one preserves all the lateral branches above and below the injury which help to maintain the collateral circulation. The 'extirpation of the sac' formerly practised almost universally, I consider to be totally wrong, because it sacrifices too much of the artery and the most important collateral branches. The arterial wall does not participate in the formation of the sac. With the exception of the intrathoracic aneurysms of the subclavian, I have operated in no case in which the artery with the preservation of its lateral branches could not be perfectly dissected away from the sac, though this work, on account of almost invariably present scar tissue, was rather laborious. One then recognizes that the destruction of the vessels is relatively only slight."

In 30 cases Bier performed arterial suture; 15 were simple, lateral sutures of the artery or artery and vein, and in 12 end-to-end suture after resection. In 3 cases transplantation of a piece of the saphenous vein into the defect was done. This is a large experience, apparently successful. One would be very interested to know whether Bier prepared himself for this special work by experimental work on animals. The laboratory men who are doing this experimental work again and again voice the opinion that a general surgeon, even with a large operating experience, should not undertake vessel suture without preliminary training in the laboratory.

It is also Bier's opinion that operations upon aneurysms, especially when suture is to be done, should, if possible, be done under artificial anemia. If this is impossible, one must get at the vessel for temporary clamping. The difficult situations will be the subclavian and iliac vessels, where for a temporary procedure one might have to turn out the clot rapidly, search for and stop the hole in the vessel deep in the sac. Bier had to do this in one of his subclavian aneurysms. This emergency scheme has been found feasible by a number of other authorities.

Bier also urges the necessity of thorough isolation of both vessels before completing the operation. Failing to do this in his first case, he sutured the opening in the femoral artery and overlooked a venous communication on the other side.

Bier's view, then, favors suture, and when ligation is to be performed, it should not be done above and below the sac, but just above and below the injury in the vessel.

As a rule, the rent in the artery is longitudinal and the suture is longitudinal. This suture presents little difficulty, because the intima tends to evert out of the longitudinal rent. Tranverse sutures were performed but three times.

When the injury in the artery is of such a size and character that suture is impossible, one must resect and perform end-to-end anastomosis. Bier prefers to make every attempt to bring the ends of the resected artery together and not to interpose a piece of vein, except as a last resort. From his experience with three cases of interposition of vein, he was impressed with the many difficulties: The vein tended to contract; it was hard to handle; it means two sutures, and secondary thrombosis is much more likely to take place.

To reduce vein transplantation to a minimum, one should confine resection of the artery to but a few millimeters beyond the defect. At this nearer point the arterial wall may appear to be extensively involved in the inflammatory process, but when one comes to handling it after the resection, it will be found that the inflammatory exudate is confined chiefly to the adventitia and that the intima is in good condition for suture.

In performing end-to-end anastomosis the tension in bringing the ends of the vessel together should not be borne by the suture until this is complete, but the approximation should be made and maintained by clamps properly protected and adjusted to the artery to be sutured.

Bier at first employed the technic of Carrel with three guides, then that of Jaboulay with two guides. Then he adopted a method of his own. The ends of the arteries were brought together with two button sutures which were tied and the needles left intact; then the continuous suture was made, first with one needle and then with the other. Of course, this was Jaboulay's and Carrel's principle.

Among the 12 cases of resection and end-to-end suture, he reports three results which were not perfectly satisfactory. In the remaining 9 cases, everything worked well. One case is of especial interest, because the aneurysm of the femoral artery was infected, and the operation therefore was through infected tissue. A large piece of the artery was infected and there was end-to-end suture. The patient suffered considerable pain from the limb suggesting faulty circulation, but there were no definite signs of gangrene. The wound suppurated. It was opened and passing through the purulent secretion was the femoral artery. The suture apparently had held in spite of the infection. The artery was thrombosed. This portion of thrombosed vessel, including the suture, was doubly ligated and excised. Gangrene did not develop. Probably in this case double ligature would have yielded as good a result at the first operation.

In the second case the injury of the popliteal artery was so near its tibial branches that, after resection, the smaller branch had to be ligated, while the larger branch was sutured to the main artery. Here were temporary symptoms which suggested impaired circulation. Fortunately, however, this righted itself.

In the third case a secondary hemorrhage was supposed to be due to a

faulty suture after an operation upon an arteriovenous aneurysm of the subclavian. At the second operation, not being able to locate the hemorrhage, the vessels were doubly ligated. Then it was found that the secondary hemorrhage was not from the suture, but from a torn branch of the artery which had not been ligated properly in the first instance. This patient died.

This article of Bier should be read in the original by every surgeon interested in vascular surgery, or whose practice brings him in contact with accidental surgery.

We must emphasize that Bier prefers vessel suture, either longitudinal or transverse, or, if this is impossible, resection with end-to-end suture. Interposition of a piece of vein should be the last resort. He emphasizes the importance of preserving the branches of the artery and not to dissect out the sac.

In the review of the experience in the Balkan wars last year, the majority of surgeons with an equally large experience preferred ligation of the artery just above and below the injury. They found that vessel suture was not often indicated. Theoretically there can be no doubt that, if properly performed, vessel suture, with restoration of the flow of blood in the vessel, should promise more than ligation. Even if the vessel suture results in thrombosis, one is in the same position as far as circulation is concerned, as if one had ligated.

Bier observed his cases from eight days to three months after the injury, and as he had only two failures in 43 cases, both subclavian aneurysms, he is rather of the opinion that any time is the time to operate, and the sooner, the better. Infection of the wound is the chief contra-indication to vessel suture. This is usually observed in aneurysms in non-perforating wound when the projectile is buried. Yet, Bier suggests that if, after the vessel suture, the vessel is covered by a piece of sterile gauze and the cavity drained, this might reduce the danger of operating through infected tissues. Bier has actually tried this with success. He also expresses the opinion that, on the whole, these wounds should be drained, especially if there are large dissecting cavities. By that he does not mean that they should be packed tight with gauze, but the wound should not be closed, as is the rule in aseptic surgery. Many points, of course, have not been settled. The most difficult complication is secondary hemorrhage associated with infection, but, considering the number of cases reported, the results have been unusually good.

It seems to me, there is enough literature now on traumatic aneurysms from wounds in war to allow one to know what is best to do in the great majority of cases. If a surgeon does not familiarize himself with this easily accessible literature, he is surely not the one to treat cases of this kind.

It is to be noted that Bier has found no objection to placing a piece

of gauze against a sutured vessel, and he recommends drainage of the wound. W. Ruehl,[1] from his experience, recommends capillary drainage after wounds of bloodvessels, or after ligation of the vessel. The drain should never come in contact with the vessel. It is Ruehl's opinion that tamponing the wound with gauze invites infection. The probabilities are that there is no disagreement between Ruehl and Bier. When Bier recommends a piece of gauze over the bloodvessel after suture, it is only in those cases in which the wound is already infected. In case, therefore, of secondary hemorrhage from wounded bloodvessels, it would be better, if possible, to operate at once rather than attempt to check the hemorrhage with gauze tampons.

The experience of Heyrovsky[2] is somewhat different from that of Bier. The report comes from Hochenegg's surgical clinic in Vienna— a base-hospital experience. Among 1710 wounded, in 30 there were wounds of large vessels. It is remarkable to note that in 21 of these cases there was late secondary hemorrhage; 3 of the cases died. In these 3 cases there was ascending thrombosis of the artery above the ligature. The opinion was expressed that in these cases the ligature was applied too close to the wound of the artery, in order to save important branches above. These men might have been saved, is the opinion expressed, if the ligature had been applied higher up.

Here we have statements exactly contrary to those we have already quoted. But perhaps in this clinic the wounds were in much worse condition, because of 30 cases, 21 were infected, 3 died, and in 6 amputation had to be performed. It would appear, therefore, that the result was due to the infection and not to the method of treatment. The 9 non-infected cases all recovered without amputation.

Otto von Frisch[3] states that the best time for operation is between the third and fifth week; in the presence of hemorrhage or infection, one must operate at once. Von Frisch shows that the consensus of opinion favors double ligation and not suture or transplantation of vessels. His experience was in the Balkan war in the winter of 1912. Then we have Subbotitsch[4] with his experience in the Balkan wars with arteriovenous aneurysms. He does not agree with von Frisch or Stoltz.[5]

It is interesting that the first two contributions from the present war by Jeger and Bier, give a somewhat different experience, and they have employed somewhat different methods from those of their predecessors in the previous war. In both, the results seem to have been pretty good.

[1] Deutsche med. Wchnschr., June 10, 1915; Journal of American Medical Association, 1915, lxv, 464.

[2] Wiener klin. Wchnschr., February 11, 1915; Journal of American Medical Association, 1915, lxiv, 1116.

[3] PROGRESSIVE MEDICINE, December, 1914, p. 243.

[4] Ibid., p. 244.   [5] Ibid., p. 238.

INJURIES OF JOINTS. W. Denk[1] reports a study of the results of injuries to joints based upon about 46 cases.

The author states that, on account of the large number of wounded, their notes were brief. There was rarely opportunity for pathological investigation, and only later for x-rays.

These cases were admitted to the hospital with the rarest exception without any fixation dressing, and the author is of the opinion that the lack of fixation is responsible for the large number of infections. He states that rest is essential to aid the joint in taking care of the primary infection.

Of the 30 wounds of joints from small-caliber bullets of infantry firearms, 14, or 46 per cent., were infected. The least number of infections was in the elbow (25 per cent.). Of course, this joint can be most easily fixed by the patient himself. The worst results are in the knee and ankle; in both, over 50 per cent. of infections.

Of wounds of larger caliber, artillery projectiles, 16 (82 per cent.) were infected, and here is an interesting fact which shows that statistics based upon small numbers must not be considered final. All four injuries of the elbow were infected, while two of the four knee-joint cases were not infected.

In favor of fixation and rest as helpful against infection, the percentage of infected cases in the upper extremity was 53, of the lower 58, while the results in the ankle were the worst, 66.

The results, as far as death and amputation are concerned, were rather good.

Shoulder, 3 infections, no amputations, no deaths.

Elbow, 5 infections, 2 amputations, 1 death.

Hip, 1 infection, 1 death.

Knee, 10 cases, 3 amputations, 1 death (10 per cent.).

Ankle, 8 infections, 4 amputations, no deaths.

We have, therefore, 3 deaths in 27 infected cases (about 10 per cent.). Von Bergmann, in 1870, lost 9 out of 11 infected knee-joints; in this group only 1 out of 10. In the Boer war 50 per cent. of the infected injuries of the knee-joint died.

In the American Civil War, among 1000 wounded in the knee, 837 died.

The percentage of infected cases has not been decreased very much since von Bergmann, in 1878—61 to 50 per cent.—but in the Boer war it had increased to 80 per cent. Apparently, the mortality has decreased. Denk attributes this to aseptic surgery.

Of course, if a wound is not infected, it does not make very much difference as to the interval of time before the patient comes under observation in the receiving hospital, but it is entirely different with infected cases.

[1] Beitr. z. klin. Chir., 1914, xci, 394.

In different wars, or in the same war in different hospitals, the percentage of the infected cases might be the same, but the results might differ widely. The shorter interval of time between the infection and the beginning of treatment in the first hospital will influence the percentage of mortality and amputations tremendously.

This observation shows that in spite of infection of a joint, we may hope to save life in the majority of cases, although we may not save the limb. The principles are, of course, the same as for any infected wounds: incision, arthrotomy, resection, amputation, always with wounds open for drainage.

With other writers from base hospitals, he attributes the infection to faulty first aid, but especially in joint wounds there may be a primary infection which will give evidence of itself in spite of proper first aid and fixation. I saw a boy, shot twenty hours before my examination, who rested quietly in bed since the bullet wound. There was every sign of gas bacillus infection. In spite of arthrotomy, amputation had to be done before he recovered.

The functional results in the non-infected joint cases, when the bullet passed through, were as a rule good, but, when the bullet was imbedded, there was more or less ankylosis.

The percentage of infections in imbedded bullets was only 45 as compared with 57 in perforating injuries. I am inclined to think that the author has not gone into this deeply enough. We know the percentage of the small bullet is 46, and of the large 81. Now, if a good many of the large were non-imbedded in through-and-through shots, it would influence the figures. One would have to compare bullets of the same caliber before coming to the conclusion as to which was most dangerous from infection—perforating, or imbedded.

This review of military surgery has allowed a discussion of some of the most difficult problems that have to do with shock, anesthesia and surgery of the extremities, the first treatment of the wound to prevent infection, and the entire subject of first aid, fixation, and transportation.

The treatment of infected compound fractures is probably one of the most difficult problems in surgery. The experience in this war with tetanus, gas phlegmons, and surgery of the bloodvessels is a very large one, and undoubtedly will add tremendously to the advancement of our knowledge in this branch of surgery.

It has been almost impossible to keep away from military surgery in this review. Its importance dominates your own mind, and it pretty well dominates the literature since September, 1914.

PRACTICAL THERAPEUTIC REFERENDUM.

By H. R. M. LANDIS, M.D.

Acetate of Aluminum. As a local application for abscesses and glandular swellings, Traeger[1] has found aluminum acetate in alcohol very useful. He employed 50 parts of aluminum acetate to 1000 parts of alcohol rectificatus; cotton dipped in this solution was layed over the affected part and covered with oiled silk. He has also used this solution in cases of smallpox. In this condition he found it most efficacious in relieving both the pain and itching.

Aconite. The potency of tincture of aconite has been investigated by Robinson.[2] The physiological effect of the active principle aconitine, as it influences the mammalian heart, has been studied by Matthews, who described two stages of aconitine poisoning. During the first stage there is a slowing of the heart, the rate being sometimes reduced one-half or one-third the original rate, with a corresponding lowering of the blood-pressure. These effects seemed to be entirely due to central vagus stimulation, as they disappeared after the administration of atropine or after cutting the vagi. During the second stage, tachycardia and arrhythmia appeared, apparently caused by the action of the drug directly on the heart muscle. Matthews considered that the drug might be employed therapeutically in such doses that the effects of the first stage alone might be obtained.

Robinson employed the drug in five cases of exophthalmic goitre. His hypothesis was that the tachycardia in this condition resulted from a lack of balance between the cardiac accelerators and the vagi and that if the so-called vagus tone could be increased, the cardiac rate would diminish.

The tincture of aconite was administered to five cases of exophthalmic goitre, three of which were moderately severe, while two were mild. The pulse-rate, after several days' rest in bed, ranged from 110 to 120 beats per minute in one case, from 90 to 100 in two, and from 85 to 95 in two cases. The effect of the drug was studied under various conditions, both before and during the administration of the drug. These conditions consisted of rest in bed immediately after a constant amount of exercise, and after the administration of a full dose of atropine. The response of the heart was studied by means of electro-cardiograms, and blood-pressure observations were made daily.

[1] Therapie der Gegenwart, May, 1915.
[2] Archives of Internal Medicine, May, 1915.

The administration to the patients was begun in doses prescribed by the pharmacopœia, namely, 10 drops three times a day. As this dose produced no untoward symptoms and had no effect on the pulse-rate, it was gradually increased until very large doses were administered. The dose in four cases was finally increased to 10 c.c. (approximately 150 drops) six times a day. Thus, in spite of the fact that four patients were receiving four times the official dose, no subjective symptoms were observed, and no slowing of the pulse-rate or lowering of the blood-pressure occurred.

A chemical assay of the tincture used and which was provided by a firm of manufacturers that had given especial attention to the preparation, showed that the preparation did not fulfil the pharmacopœal requirements as regards its aconitine content, although the discrepancy was not sufficient to account for the impotency of the drug. The physiological assay, made by C. W. Ballard, showed that the minimal lethal dose for guinea-pigs of a substance giving the chemical tests for aconitine contained in the tincture was at least forty-five times as large as that of crystalline aconitine, and that the alcohol of the tincture apparently played no role in diminishing the toxicity of the solution by decomposing the aconitine. This substance in the tincture can hardly, therefore, be considered identical with crystalline aconitine. These facts emphasize the necessity of physiological standardization of the tincture of aconite, which is not now required by the pharmacopœia.

Last year, in reviewing an article by Piersol on the management of high blood-pressure, mention was made of the fact that he had tried the tincture of aconite, but without producing any lowering of the pressure. Opposed to this opinion and to the results obtained by Robinson are those reported by Thomson[1] who believes that the tincture of aconite, given in 10-drop doses, four times daily, is the most efficient vasodilator we possess. In addition, he reports good results from the employment of the drug in maniacal conditions.

Alcohol. For the past few years the alcohol question has been assuming more and more importance, and at the present time a large part of this country is enthused by the desire to abolish its use entirely. The present crusade, as in the case of others that have gone before it, is being worked up, as Lloyd[2] remarks, by enthusiasts who make a great deal of noise; they do some good and more harm; will finally exhaust themselves, and the country will once more settle down again and take its beer and whisky. Considered as a sociological question, there can be no doubt that society as a whole would be better without it. To obtain this end, however, it is necessary to convince the people that they will be capable of doing better work; that they will be infinitely happier without their tipple; and, finally, that abstinence means better

[1] American Journal of Medical Sciences, 1915.
[2] Therapeutic Gazette, July, 1915.

health. There can be no doubt also that overindulgence with alcohol is liable to lead to a variety of organic diseases. The nervous system is especially vulnerable, and there are a number of mental conditions which owe their origin to the excessive use of alcohol. In regard to the role played by alcohol in the production of mental disorders, Lloyd emphasizes the fact that there are a number of fallacies being promulgated on the subject by too ardent reformers. One of these fallacies is the statement that our insane asylums are largely populated by the victims of alcohol. Lloyd insists that statistics properly compiled do not prove this. Thus the figures taken from one institution during the past year show that, of 114 new cases admitted to the female department, only 3 (2 per cent.) could be considered as being alcoholic, and of these 1 was a syphilitic and another was addicted to the use of opium. This leaves but 1 undoubted case in which the insanity could be attributed to alcohol. Among 85 new male patients, 6 were suffering from some form of alcoholic insanity—about 7 per cent. Lloyd quotes the observation of others in confirmation of his opinion.

There can be no doubt that the zeal for universal prohibition has clouded the issue, and that not a few medical men have taken the stand that as alcohol is harmful if taken as an indulgence or as a luxury, it is therefore harmful as a therapeutic agent. It has been reported in the public press that the committee on the revision of the Pharmacopœia has rejected alcohol as an official remedy. This, it seems to me, is a mistake. While freely admitting that alcohol has been abused as a therapeutic agent in the past, and that it was routinely employed in a variety of conditions in which there was no great need for it, it seems to me that it still has a place in our therapeutic armamentarium. For instance, a recent editorial article[1] in commenting on the revival of ipecac points out the fact that this drug was used empirically for years; was lost sight of and only recently revived. As the editorial states, it is quite possible that there may be other remedial agents used by our fathers which are well worthy of being given a trial. I have alluded to this because the clinicians of former generations used alcohol freely and with good results. Furthermore, we have the testimony of men of undoubted integrity, such as Austin Flint, that he never saw any ill effects from its use.

Hare[2] in an article on the clinical use of alcohol, closes with the following statement:

"We cannot afford to accept too quickly evidence that comes from the laboratory or from the bedside, nor can we afford to condemn universally a remedy which does not seem in the laboratory to do to a healthy dog what it does to a sick man. No better illustration of this can be afforded than alcohol given to a healthy man in distinction

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[1] American Medicine, 1915.
[2] Therapeutic Gazette, July, 1915.

to alcohol given to man in disease. Given to the man in health, except under certain circumstances and in very carefully graded doses, it is harmful because it affords him something which he can burn up readily and thereby is prone to interfere with the proper oxidation of his ordinary foodstuff; whereas, given to a man in fever, whose ability to assimilate food is impaired and whose circulation may be impaired and disordered, it provides energy, acts as a foodstuff, and regulates the circulation.

"This discussion is designed not to loudly sing the praises of alcohol; it is intended to emphasize the point that he who utterly casts it aside deprives himself of a valuable tool at certain times; that he who uses it in excess does harm; but that he who prescribes it in proper form and in proper dose and at the proper time may consider alcohol one of his standard remedies just as he considers any other drug possessing activity capable of doing good."

Fussell[1] states that when he began the practice of medicine he followed the old teaching of using routinely large doses of alcohol in the treatment of acute infections. As the years have gone on, however, he has restricted his use of alcohol more and more. It is now his practice to use alcohol in a few selected cases and never to employ it in a routine manner. Fussell, in his consideration of the subject, gives what, in his judgment, are the indications and the contra-indications of the drug.

Indications. 1. Its use in those who have been habitual users of alcohol but who are not necessarily hard drinkers. When such an individual develops pneumonia, for instance, small doses of whisky or brandy will often forestall restlessness and mental disturbance. In these cases a small dose, three ounces in twenty-four hours, is just as effective as a larger dose and is safer. The small doses prescribed in these cases simply make the nervous symptoms less likely to appear.

2. Delirium Tremens. There are two opinions in regard to the treatment of this condition. Some believe in absolute withdrawal and depend on quieting the nervous symptoms by means of sedatives, such as chloral. Others believe in gradually reducing the dose, and it is this method that Fussell recommends. It is, of course, understood that neither view obtains for all cases.

3. Chronic alcoholism associated with diseases of the bloodvessels, heart, and kidneys. In the majority of these cases Fussel believes that while sudden withdrawal of the alcohol is the best practice in the majority of cases, there are certain cases in which degeneration of the vessels or kidneys goes on rapidly if cessation is abrupt.

4. Diabetes Mellitus. Diabetics apparently are able to burn up large quantities of alcohol, not only without detriment, but with great benefit. It may be given in moderate amounts as a daily ration or it

[1] Therapeutic Gazette, July, 1915.

may be used occasionally in large amounts on the days when food of small caloric value is given.

5. Infectious Diseases. The employment of alcohol in the management of the acute infectious diseases is one of the most disputed points in its use. Fussell never uses alcohol in the treatment of these conditions unless (1) the patient has been an alcoholic, or (2) the administration of food is so difficult that two or three ounces of whisky or brandy in twenty-four hours are given in the hope that it will be of some food value.

While there is some unanimity of opinion that alcohol is not needed in the acute sthenic fevers, such as pneumonia, there is still a great difference of opinion regarding its use in cases of severe and prolonged infections, such as typhoid fever. Fussell finds little or no place for alcohol in the management of typhoid. Hare,[1] on the other hand, insists that alcohol does a great deal of good in many cases of prolonged fever by establishing circulatory equilibrium. In his opinion there are only two drugs which approach it in value for this purpose, possibly three, namely, atropine, camphor, and the nitrites. The nitrites are apt to act too suddenly and forcefully and are too fleeting; atropine stops the secretions which the alcohol often increases. The exact value of camphor is hard to determine.

Finally, Hare is strongly of the belief that alcohol in severe infections increases the phagocytic power of the blood and still more surely increases bacteriolysis. It is in this type of infection that the older clinicians administered alcohol freely and there can be but little doubt that they obtained favorable results.

Contra-indications. Fussell does not approve of the use of alcohol under the following circumstances: (1) As an appetizer. (2) As a food, except in the case of diabetes. (3) In the treatment of tuberculosis. The routine employment of alcohol in tuberculosis is undoubtedly bad. I do not agree, however, that it should never be used. (4) In nervous diseases, particularly of the functional type because of the danger of establishing the habit. (5) Exposure to heat or cold. (6) In snake-bite or other acute poisoning. (7) Fussell condemns the use of alcohol as an indulgence by healthy, normal individuals.

Antimony. The use of antimony in affections due to spirochetæ has been favorably commented on during the past year. While the action of antimony, particularly tartar emetic, has pronounced emetic effects, its systemic effects resemble those produced by arsenic. McWalter,[2] while making no extravagant claims for the drug in the management of syphilis, states that he has employed it in combination with mercury with excellent results during the past fifteen years. He employs the drug in the form of the red sulphide or antimonium sulphuratum

[1] Loc. cit.
[2] British Medical Journal, October 10, 1914.

in doses of from 1 to 2 grains over a period of from two to three months. He quotes Neisser to the effect that the ideal way to treat syphilis is to combine arsenic, as in salvarsan, with mercury, and that this combination can be made still more powerful by adding antimony to the combination. Instead of massive doses of salvarsan ("therapia magna sterilisans" of Ehrlich), Neisser advocates a combination of the above-mentioned drugs in moderate doses, continued for over a year. Thus, while a non-toxic dose of each drug may be given, the combined effect is powerful. Some spirochetæ are affected more by mercury, some by arsenic, and some are probably more affected by antimony.

McWalter believes the antimony is of very considerable value when the syphilitic virus attacks the nervous and epithelial tissues. For years Plummer's pill, which contains sulphide of antimony, has enjoyed the reputation of being specific for skin diseases of a syphilitic type. In McWalter's experience, the effects of antimony on syphilitic lesions are very much like those of arsenic but is distinctly milder in character, and seldom, or never, followed by optic neuritis or by the fatal effects attributed to arsenical compounds.

During the seventeenth and eighteenth centuries antimony was extensively employed in a variety of conditions and, indeed, it is only within the past generation that the drug has passed out of use. At one time it gave excellent results in the treatment of various types of mania, and it seems safe to assume that many of them were of syphilitic origin, the beneficial effects being brought about by the destruction of the spirochetæ.

Tartar emetic (antimony and potassium tartrate) is highly spoken of by Castellani[1] in the treatment of *yaws*. He employs the following mixture:

Tartar emetic	gr. j
Sodium salicylate	gr. x
Potassium iodide	ʒj
Sodium bicarbonate	gr. xv
Water	ʒj

This dose is given diluted in four ounces of water, twice daily to adults and children over fourteen years of age; half-doses to children from eight to fourteen years; and a third or less to younger children.

He has treated eleven cases in this way with good results. The mixture is given for ten to fifteen days, then discontinued for five to ten days and again given for ten to fifteen days. The best results were obtained in recent cases, that is, those of three to twelve months' standing. In very old cases the results were much less satisfactory, and in no way to be compared to salvarsan and neosalvarsan.

Castellani concludes that salvarsan and neosalvarsan are specific

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[1] Journal of Tropical Medicine and Hygiene, March 15, 1915.

in the treatment of yaws. But if for any reason an internal treatment by easily obtainable drugs is desirable, the above mixture can be recommended, especially in cases in which the infection has existed but a short time. The active drugs in the mixture are the potassium iodide, and, to a much less degree, the tartar emetic. The sodium salicylate seems to hasten the disappearance of the crusts, while the presence of a large amount of sodium bicarbonate prevents the occurrence of iodism and decreases the emetic effects of the tartar emetic, thus making it possible to give large doses of these drugs.

Castellani[1] also reports a case of *kala-azar*, in which improvement, so marked as to amount to a cure, was obtained with a mixture of tartar emetic, potassium iodide, sodium salicylate, and sodium bicarbonate. In addition to the daily administration of the above mixture, he gave an intravenous dose of tartar emetic every tenth day, alone or in combination with Fowler's solution. Castellani believes, however, that the tartar emetic was almost entirely responsible for the good result.

Di Cristina and Coronia[2] report excellent results in the treatment of *internal leishmaniasis* with tartar emetic. The mortality from this disease is very high in Italy, especially in young children. Di Cristina found the mortality 93 per cent. in children under two years of age and 87 per cent. in older children, among 130 cases. In view of this high mortality among children, it is interesting to note that of eight children from five to twenty-seven months old, all but one recovered.

They administered the tartar emetic intravenously in the form of 1 per cent. solution in redistilled water. The course of treatment ranged from ten to forty days and the total amount of the drug used was from 0.06 to 0.84 gm. One child died from nephritis following large doses of the tartar emetic from the start, from 0.04 to 0.03 gm. While this controlled the leishmaniasis, the kidney trouble developed. As a result of this experience, treatment was started with small doses gradually increased until a total of 0.35 to 0.75 gm. had been given over a period of from twenty-one to forty days. In this way any possible kidney injury can be detected in its incipiency.

Antidiphtheritic Serum. During the past few years a number of articles have been published regarding the proper dosage of diphtheria antitoxin. One result has been to show that very large doses are not attended by ill effects. Another marked change has been the method of administration. Formerly the subcutaneous route was the only one employed. It is now recognized, however, that the intravenous route is much preferable in very severe cases; and still another innovation is the intramuscular method. The advantages of the latter were pointed out in PROGRESSIVE MEDICINE for last year in reviewing an article by

[1] Pediatria, April, 1915.
[2] Ibid., February, 1915.

Rolleston and MacLeod. Further on mention will be made of additional testimony in favor of this method.

Up until quite recently the dose of antitoxin has been governed largely by clinical experience. For several years Schick[1] has been working on this problem and has finally devised a method which seems to indicate the proper amount of antitoxin necessary for the individual case. Schick, some years ago, conceived the idea of using diphtheria antitoxin in the manner that tuberculin was employed by von Pirquet in determining infection with the tubercle bacillus. By this method he was able to determine whether the individual was susceptible or immune to diphtheria. For this purpose he employed 0.1 c.c. of toxin dilution which contains exactly $\frac{1}{50}$ the minimum lethal dose. This was injected intracutaneously. A negative reaction to $\frac{1}{50}$ the minimum lethal dose for a 250-gm. guinea-pig indicated that the individual had at least 0.031 units of antitoxin per cubic centimeter of blood, which quantity he believes to be sufficient to protect the individual against diphtheria.

Woody[2] prefers a dilution in which 0.05 c.c. contains $\frac{1}{50}$ the minimum lethal dose, as the results seem to be quite as constant and the discomfort accompanying the injection of the smaller quantity is less.

If there is an absence of antitoxin in the blood, a positive reaction appears in twenty-four hours. This is indicated by the presence of a circumscribed, hyperemic, indurated area, which usually becomes most marked in forty-eight hours and persists for from a week to ten days. It heals by central brownish pigmentation and scaling, which clears up in from two to three weeks. Woody states that a pseudoreaction is sometimes encountered in older children and adults, which does not show the same degree of induration nor the typical scaling and pigmentation. In a series of 524 cases, two instances of this sort were encountered.

This local skin reaction has a direct bearing on treatment of human diphtheria. The work of Schick and his associates showed that the dose of antitoxin could be calculated according to the weight of the patient. As a result of their experiment, they found that, in the majority of cases, 100 units per kilogram ($2\frac{1}{5}$ pounds) of weight suffices. If the dose is increased to 250 or 500 units per kilogram of weight, the influence on simultaneously injected toxin is somewhat improved, but there is no increase whatever in the immunizing effect. Schick therefore recommends that in all mild and medium cases of diphtheria (and these constitute about 90 per cent. of all cases), a single dose of 100 units of antitoxin per kilogram suffices, but that in the severest cases 500 units per kilogram may be injected. For example, a child weighing 20 kilograms (44 pounds) will receive, in 90 per cent. of the cases, 2000 units. If the case is severe, 10,000 units for the same weight may be given. Again, an adult weighing 60 kilograms (132 pounds) should

[1] Zeitschrift f. d. ges. Exper. Medicin, 1914, iv, 83.
[2] Journal of American Medical Association, April 10, 1915.

receive 6000 units, or, if the case is severe, a single dose of 30,000 units may be given.

As pointed out in an editorial article,[1] the result of these observations, if correct, is of the greatest importance. They not only furnish a definite method of determining the dose, but they also indicate that the enormous doses sometimes given are unnecessary. The latter point is of some importance on the ground of expense. Another very important consideration, as pointed out by Woody, is that the test is of definite clinical value in differentiating between persons who are susceptible to diphtheria and those who are immune. In institutions, for instance, where it is customary to immunize all who have been exposed to the disease, it would be a great saving to know those who were susceptible and those who were not. Furthermore, the test makes it possible to distinguish cases which are doubtful.

Kolmer and Moshage[2] state that about 40 to 50 per cent. of children ranging from one to fifteen years of age react positively to the test; this means that the preliminary use of the toxin test will eliminate the necessity of administering prophylactic doses of antitoxin in about 50 per cent. of children exposed to the disease. These observers confirm the opinion that the skin test is a valuable and reliable method for detecting susceptibility to the disease, and that persons reacting negatively to this test usually contain at least $\frac{1}{20}$ unit of diphtheria antitoxin per cubic centimeter of serum, this amount being probably sufficient to protect against infection. Individuals who react weakly or strongly usually contain less than $\frac{1}{40}$ of a unit of antitoxin per cubic centimeter of serum, or none at all. Such cases should be regarded as susceptible to diphtheria, and, in the event of exposure to infection, should be passively immunized with an injection of antitoxin. Kolmer and Moshage state that the toxin reaction indicates that the immunity conferred by an attack of diphtheria is usually of short duration or entirely absent.

Veeder[3] applies the Schick test to all individuals exposed to the disease, and, in case the reaction is positive in twenty-four hours, 1000 units of antitoxin are given to older children and 500 units to children under two years.

As I have already stated, the subcutaneous method is being largely superseded by the intramuscular and intravenous routes. Schick[4] and his colleagues advocate intramuscular injections as the method of choice. Veeder[5] recommends, for the mild and moderately severe cases, the intramuscular injection of from 3000 to 5000 units. For the severe and septic cases, for all laryngeal cases and for all cases seen after the

[1] Journal of American Medical Association, December 12, 1915.
[2] American Journal of Diseases of Children, March, 1915.
[3] Missouri State Medical Association Journal, April, 1915.
[4] Loc. cit.   [5] Loc. cit.

fourth day, if the membrane is at all extensive, he employs intravenous injections. In regard to the intramuscular injections, Veeder states that from the clinical point of view they have been almost as equally efficient as the intravenous method. The reaction is much less severe than that following the intravenous injections and are apparently no more painful than those given subcutaneously. He has used both the spinal and gluteal muscles as the site of the injection and has adopted the intramuscular method as the routine procedure in the average case. The technic employed by Rolleston and MacLeod[1] is very simple. Without preliminary washing, the outer side of the thigh in its middle third is painted with a 2 per cent. solution of iodine. The needle is then driven deep into the body of the vastus externus and the injection is then given in the ordinary way.

Schorer[2] states that, in the late and in all severe cases, intravenous injections undoubtedly produce results more rapidly, and so are to be preferred. He believes that they are less painful at the time of administration and later, and that fewer units are necessary, thus reducing the expense. In case the median basilic and cephalic veins are too small, Schorer states that the jugular vein in children affords a ready site for the injection. Although the number of cases he reports is small (14), he believes that the series indicates that there will be fewer cases of carriers and heart failures following the intravenous method. There were, however, more instances of severe reaction, but these were not severe and need not be considered to be a contra-indication to the intravenous injection of diphtheria antitoxin.

The intravenous route in cases of laryngeal diphtheria is advocated by Nicholson.[3] He states that in 1912, 75 cases were treated by the intramuscular and subcutaneous methods, with a mortality of $10\frac{5}{7}$ per cent. In 1913, 100 cases were treated by the intravenous method, the death-rate being 5 per cent. plus, and including deaths occurring within a few hours after admission. As a result of this experience, he is of the opinion that convalescence is more rapid and vigorous than in those cases in which antitoxin was administered in the muscle or under the skin. Smaller amounts of antitoxin are needed by this method but it does not do away with the necessity of intubation unless administered early in the disease. He warns against injecting the antitoxin intravenously if the patient has received the serum previously.

Nicholson's technic is as follows: Iridoplatinum needles were used exclusively. A small piece of rubber tubing is fitted to the needle and sterilized by boiling them together. The end of the syringe containing the antitoxin is dipped into tincture of iodine and then dried with a

[1] Lancet, October 10, 1914.
[2] American Journal of Diseases of Children, January, 1915.
[3] Bulletin of Medical and Chirurgical Faculty of Maryland, October, 1914.

piece of sterile gauze and the rubber plug removed. The needle is then connected. The site of election is the median basilic vein. Usually there is no difficulty in puncturing the vein, but, in some instances, particularly in small infants, the vein has to be exposed by an incision. Shorer,[1] it will be recalled, advised using the jugular vein if the arm veins were inaccessible. At the beginning of this work, Nicholson administered as much as 20,000 units at a single dose. Later he found that 5000 units usually proved efficacious although occasionally, in very bad cases, 10,000 units were employed.

It seems to be apparent that, except for minimizing purposes, the subcutaneous method will eventually disappear. The testimony thus far offered in favor of the intramuscular and intravenous routes indicate that the results are not only more certain, but that less antitoxin is needed. Certainly, so far as the technic of administration is concerned, the later methods offer no more difficulties than the ordinary subcutaneous injection.

As a matter of passing interest, mention may be made of the *treatment of pernicious anemia by means of diphtheria antitoxin*. Bartolotti[2] treated one case in this way. He states that antistreptococcus and antistaphylococcus serum have the same action but to a much less degree. The case he reports received four injections of 1000 units each, with intervals of forty, sixteen, and twenty-one days. No allusion is made to the possibility of producing severe anaphylactic phenomena by these repeated doses. The danger of such an occurrence would seem to outweigh the doubtful advantage of improving the anemia.

DIPHTHERIA CARRIERS. The very fact that the literature each year contains several references to the treatment of diphtheria carriers is pretty good evidence that, up to date, no satisfactory method has as yet been devised. Last year I mentioned three or four different plans. As I have seen no further reference to them, it must be assumed that either they failed in the hands of others or that they did not appeal as being of service.

Besides the use of *kaolin*, to which I have already alluded, several additional methods have been put forward. R. T. Hewlett[3] recommends the use of diphtheria endotoxin. This is composed of the intracellular constituents of the bacillus obtained by disintegrating the bacterial cells by grinding, by the Macfadyen method. This consists in obtaining a good bacterial growth on blood or serum agar, collecting it, washing it by centrifuging two or three times with sterile physiological salt solution without heating, and then grinding in a special machine (see "The Cell as the Unit of Life," Macfadyen and Hewlett) after the bacterial mass suspended in salt solution has been frozen by the

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[1] Loc. cit.
[2] Policlinics, May 9, 1915.
[3] American Medicine, May, 1915.

intense cold produced by liquid air or by ether and carbonic acid snow. After thawing, the fluid is filtered through a small Berkefeld filter candle so as to remove any whole bacilli that may have escaped trituration and the fluid is diluted so as to contain 5 mm. of bacterial material per cubic centimeter; this is arrived at by drying *in vacuo* a measured volume of the fluid and weighing. A little antiseptic, such as trikresol, may be added and the liquid put up in ampoules.

Hewlett pursues the following method: The first dose of the endotoxin is 2.5 mgms.; this is followed after an interval of seven to eight days by a second dose of 5 mgms., and, if necessary, by a third dose of 7.5 mgms. after a similar interval. The endotoxin is injected into the muscles of the upper arm or between the scapulæ. Some redness, tenderness and swelling at the seat of injection may occur, but this soon passes off.

Of 23 cases so treated, 17 became free from bacilli, and 6 did not. Hewlett believes that in at least half of the cases the disappearance of the bacilli could be attributed directly to the effect of the endotoxin.

Weil[1] believes that diphtheria vaccines will destroy the bacilli in many chronic carriers and that, even when they do not entirely disappear, the number of bacilli is markedly diminished. Large doses of vaccine seem to be more efficacious than small ones.

Still another method has been recommended by Kassowitz.[2] In the presence of an institutional epidemic, he makes a bacteriological examination of every person who has been in contact with the disease and repeats it at the end of a week at the latest. Those giving positive findings are at once sent away and the institution closed until thorough disinfection has been done. The carriers are given the Schick test, and those responding with a positive reaction are treated with antitoxin. For local treatment, he employed a 0.5 per cent. solution of hydrogen peroxide. By following this method he stamped out an epidemic after five cases of diphtheria and carriers among fifty-two children had been discovered.

Antistreptococcic Serum. Although a large number of serums designed to combat streptococcus infection have been produced, none of them have achieved any marked success. Nicoll[3] reports on the use of a polyvalent serum in the treatment of *chronic arthritis.* The results were highly unsatisfactory. Nicoll states that clinical observation and the estimation of immune bodies did not show any added advantage from the use of an antiserum in chronic arthritis even when a concentrated serum with much greater potency than the usual commercial serums was employed. In two cases, acute streptococcus infections arose during, and in spite of, its administration.

[1] New Orleans Medical and Surgical Journal, November, 1914.
[2] Münchener med. Wochenschrift, September 15, 1914.
[3] Journal of American Medical Association, December 19, 1914.

Aside from the fact that the serum did not relieve the condition, its administration is not entirely free from danger. If given in repeated doses, 25 per cent. of the cases may develop dangerous degrees of anaphylaxis, even in patients who give no history of previous use of horse serum or of asthmatic symptoms.

As a result of his experience, Nicoll does not believe that the use of antistreptococcus serum in the treatment of chronic arthritis is either advisable or justifiable.

Antirabic Serum. During the past summer was celebrated the thirtieth anniversary of Pasteur's introduction of his treatment of rabies. Although Pasteur had conclusively proved, experimentally, the efficacy of his treatment toward the close of 1884, it was not until July 6, 1885, that he had the opportunity of applying it in man. An editorial article[1] points out the great benefits this discovery has conferred to the human race. Prior to Pasteur's discovery, the only available method of treatment was cauterization, which was of little avail in case the bites were multiple and lacerated, and in the case of those situated on the head and face. The statistics of Proust showed that, in a series of 117 cases which were not cauterized, there were 96 deaths. Among 249 cases in which cauterization was practised, there occurred 89 deaths. These figures represent about what happened prior to the introduction of Pasteur's antirabic treatment. From 1886 to 1914 the world's record of death from rabies has been less than 1 per cent. As shown by the editorial article, Högyes has collected statistics for 54,620 persons treated at twenty-four institutes, with a mortality of only 0.77 per cent. Bernstein's figures include 104,347 patients, with a mortality of 0.54 per cent. "Surely these figures tell a victory against death in a way that puts the inhuman warfare of the civilized nations in a sad light in comparison with this record, the fruits of one man's genius as a human benefactor."

Antitetanic Serum. While during the past year our chief interest in the disease, and especially in its treatment, lies in the published reports from the various centres of military operations, it must be remembered that these reports are by no means complete, so that conclusions must not yet be made, and due allowance must also be made for differences of opinion expressed by different reporters—in accordance with their several experiences.

Among the strictly "war zone reports," the following may prove of interest:

Walther[2] saw 20 cases, all from one district along the Marne (long known as the tetanus district); these cases were confined to shrapnel wounds. The writer's opinion is that these infections were only in wounds produced by shrapnel striking the ground first, or by explosion,

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[1] Journal of American Medical Association, July 3, 1915.

[2] Bulletin de l'Académie de Médicine, October 6, 1914.

driving dirt into the wounds. He urges the French authorities to provide sufficient antitetanus serum for routine treatment of shrapnel injuries.

Kreuter[1] reports from the hospital at Erlangen, a number of cases of local tetanus, *i. e.*, with cramps restricted to the area immediately surrounding the wound, with 80 to 90 per cent. mortality, in incubation periods of less than eight to ten days. In two cases he tried amputation of the wounded limb (immediate), but both resulted fatally. In addition to the antitetanic serum, he urges the employment of other methods for relief of the convulsions, and gives morphine every two or three hours with a single dose of chloral at night.

In employing magnesium sulphate (after the technic of Meltzer and Auer), while greatly relieving convulsions, such serious embarrassment of breathing followed that artificial respiration was necessary. He offers as a suggestion tracheotomy and insufflation of oxygen in these cases, and condemns as useless Bacelli's phenol method.

Kocher,[2] to whose article on tracheotomy and oxygen insufflation the above report refers, in reviewing recent literature on tetanus, advocates for *every* wounded soldier a prophylactic (presumably subcutaneous) injection of 10 to 20 grams of the antiserum—on the slightest sign of appearance of tetanus—an additional injection under local anesthesia into the vicinity of the wound and exposed muscle, and an endoneural injection to block the nerve, and, in addition, an intraspinal injection of 10 c.c. after allowing a similar amount of spinal fluid to first escape. He also advocates, in vigorous individuals with marked excitability and muscular rigidity, supplementary subcutaneous injections of from 30 to 45 grams of a 25 per cent. solution of magnesium sulphate—and from 2 to 12 grams of chloral in the twenty-four hours. In cases growing worse under these measures, he recommends the subdural injection of 10 c.c. of a 15 per cent. solution of magnesium sulphate which he has repeated as often as ten times in a single case (the results of which are not given). He urges also the importance of copious water internally, enemata, and ice-bags to the surface of the body.

An interesting proof of the successful abortive treatment of tetanus by the injection of small quantities of the serum is furnished by Teutschlaender, who isolated the organism from the wounds of three men, two of whom showed no further symptoms—one developing slight painless spasm of the sole of the wounded foot, when another small dose was given with no further symptoms. Vigorous local disinfection of the wounds was employed—in spite of which tetanic organisms of sufficient virulence to kill a mouse were recovered weeks later. The above evidence leads us to accept *"cum grano salis"* a recent expression of opinion by Koch[3] that the wounded develop tetanus not because of

[1] Münchener med. Wochenschrift, October 6, 1915.
[2] Deutsche med. Wochenschrift, November 17, 1914.
[3] Therapeutische Monatshefte, March, 1915.

infection, but by reason of proliferation of bacilli in the wound, *ergo*, that if we clean the wound with water and potassium permanganate, there will be no tetanus.

Writing in the early days of the war, Czerny[1] expresses the fear that tetanus will decimate the wounded. The number of cases he attributes to the overcrowding of hospital cars, so that many wounded must be transported to base hospitals in freight cars—in which horses have been shipped to the front, but owing to the necessity of haste, pressed into use without cleansing. In September, 1914, he saw four cases of tetanus developing on the way, a journey of only two days. He also inclines to the views of Larrey, who, writing in the Napoleonic wars, cites increase in tetanus during sudden changes of temperature and bad arrangements for transportation. While, of course, advocating the use of the antiserum, he suggests the possibility of checking the infection by immediate sterilization of the wound by superheated air on the principle that the toxin of tetanus is known to be developed by heat. He also calls attention to the important clinical fact that local spasm near the injury is often the first danger symptom.

It is interesting to note that in October, 1914, Jacobsthal[2] urges the routine prophylactic use of antitetanic serum in all cases of dirty wounds—and realizing then that there was not sufficient serum on hand in Germany to permit this, he insists that more should be made wherever possible. Less than four months later Behring states that provision for 100,000 prophylactic doses per month of 20 units each, have now been made.

Ritter,[3] in his report of wounded in Bavaria up to last February, reports 60,000 with a mortality of only 0.7 per cent., of which tetanus was responsible for over one-half, *i. e.*, 0.4 per cent. of all wounded. His experience in regard to treatment have been disappointing, especially the later reports regarding magnesium sulphate which are much less favorable than in the early part of the war. He even finds that the serum fails to ward off the disease in all cases, and urges more vigorous attacking of the wound from the start; advocating Friedreich's method of incising into the sound tissue for at least 1 cm. both superficial and deep; or to employ, in addition, Bier's local hyperemia. In addition, he approves of copious application of Peruvian balsam to check the production of hard crusts, and of painting with tincture of iodine.

In March, Goldscheider[4] makes the important statement that since the routine employment of 20 to 40 units of the antiserum in all wounded no further cases of tetanus have been seen.

In reports from one of the German hospitals, Grundmann[5] shows a

[1] Deutsche med. Wochenschrift, October 29, 1914.
[2] Münchener med. Wochenschrift, October 13, 1914.
[3] Berliner klin. Wochenschrift, February 8, 1915.
[4] Ibid., March 15, 1915.   [5] Ibid., February 22, 1915.

tetanus mortality of 65 per cent., of which 10 per cent. were moribund on admission.

In addition to the routine therapeutic use of the serum (this was before the prophylactic treatment could be routinely used with all wounded at the front), he urges such auxiliary measures as a quiet, dark room, light nourishment every hour; and leaving the wound alone, save for primary cleaning with H_2O_2, followed by iodoform and repeated daily injections around the wound of 80 to 100 units of the antiserum. He advocates warmly the use of magnesium sulphate in subcutaneous injections, three or four times daily 20 c.c. of a 10 or 15 per cent. solution, but he urges beginning tentatively with small doses, not over 5 c.c. and increasing gradually. He also calls attention to the necessity of large doses of the antiserum to wounded men lying next to tetanus cases, having seen two cases in a crowded ward from two or three weeks after the admission of tetanus cases.

Cluetta,[1] in a pharmacological study of the use of magnesium sulphate utterly condemns this method.

The *West London Medical Journal*, January, 1915, states that, in the British Army, tetanus antitoxin is the routine prophylactic treatment of all wounds with danger of dirt contamination. With tetanus supervening, chloretone has been found most useful to control muscle spasm. It is administered in 60-grain doses in warm olive oil enemata, repeated when muscular rigidity increases.

An interesting review of the treatment of tetanus by the London Medical Society was reported in the *Lancet* of December 12, 1914. Embleton argued strongly against the local use of phenol to the wound, because of the improbability of localization of the tetanus organisms. He states that the value of the antitoxin as a prophylactic was unquestioned. No doubt was expressed at the meeting of the value of the antitoxin as a prophylactic and a therapeutic agent; the only difference of opinion being the method of administration. The intracranial method had no supporters.

Of the non-military reports, by far the most important is the paper contributed by Irons,[2] of Chicago, the conclusions of which are:

The course of tetanus can be modified, and life often saved by the proper use of antitetanic serum. Delays in giving antitoxin, complications of sepsis and other late complications, and inadequate methods of use of the serum have combined (unjustly) to cause doubt on its curative value.

Small doses of the serum, given subcutaneously every few hours, increasing as symptoms increase, is to be strongly condemned as expensive, useless, and due to ignorance of the pathogenesis of tetanus.

With early cases, large doses of the serum should be given intra-

[1] Correspondenz-Blatt f. Schweizer Aerzte, January 2, 1915.
[2] Journal of American Medical Association, May 8, 1915.

venously, and, combined with an intraspinal injection to neutralize the toxin in the central nervous system, plus judicious use of sedatives and other medical and surgical indications, promptly met, will result in saving many lives.

The necessity of thoroughly cleaning every wound in which there is a suspicion that tetanus may occur has been repeatedly urged. Indeed this measure will of itself prevent many cases of the disease which would otherwise occur. Any wound, no matter how received, if contaminated with street dirt or soil which is fully manured should receive a thorough cleansing and, in addition, a prophylactic injection of antitetanus serum should be given, if possible. The following rules[1] emphasize the procedure to be followed:

1. Carefully and thoroughly remove every particle of foreign matter from the wound, laying it open; an anesthetic should be given, if necessary.

2. Dry the wound thoroughly, and paint it and the surrounding parts as carefully as possible with iodin, or else cauterize it thoroughly with a 25 per cent. solution of phenol (carbolic acid) in glycerin or alcohol.

3. Apply a loose wet pack, using a solution of some such antiseptic substance as boric acid or alcohol.

4. As soon as possible inject intravenously or subcutaneously 1500 units of antitetanic serum and continue the injections if indications of possible tetanus arise.

5. In no case close the wound. Allow it to heal by granulation. Remove the dressings and packing each day and apply fresh ones.

Auregan[2] advises dressing the wound with colloidal iodine. This, together with intramuscular injections of antitetanic serum, has given him a much higher percentage of recoveries than when serum alone had been employed.

Behring[3] thinks that wounds with bad-smelling secretions had better be treated with iodoform in coarse crystals, while those of benign aspect should be irrigated with a 0.1 or 0.5 per cent. solution of iodine trichloride.

Irons[4] urges the immediate employment of the serum on the first manifestation of symptoms. It is essential to obtain the full effect of the serum as soon as possible. This may be done by giving 300 to 5000 units intraspinally, and 10,000 to 20,000 units intravenously. On the following day the intraspinal injection may be repeated. The blood remains strongly antitoxic for several days, but on the fourth or fifth day a subcutaneous injection of 10,000 units should be given to maintain this antitoxic effect. If only a limited amount of antitoxin (3000 to 5000 units) is available, it should be given intraspinally.

[1] Journal of American Medical Association, June 26, 1915.
[2] Lancet, February 27, 1915.   [3] Deutsche med. Wochenschrift, October 8, 1914.
[4] Journal of Infectious Diseases, September, 1914.

Schneider,[1] in reporting 22 cases of tetanus, states that of 12 cases treated with subcutaneous injections, none recovered; while of 9 in which the serum was given intravenously, 3 recovered.

Irons points out that none of the other recognized procedures should be omitted. The wound should be thoroughly cleaned, the patient placed in bed in a dark room and should receive sufficient fluid to assure proper kidney elimination. Sedatives are also necessary to control the convulsions but care must be taken to see that in the effort to secure quiet, the dose of the sedative is not unduly exceeded. Irons recommends chloral or chlorbutanol.

Meyer[2] reports a case in which recovery followed the administration of 102,000 units of antitetanic serum.

D. G. Smith[3] has reported an interesting example of anaphylaxis following the administration of tetanus antitoxin. The following were the principle features: (1) There was an interval of nine days between the injection of the serum and the onset of the anaphylactic symptoms; (2) an eruption of a dual type, lasting four days; (3) edema of the face, lasting six days. The edema appeared after the disappearance of the eruption, and, although hardly discernible in the morning, by afternoon the face was tremendously puffed. The eyelids became so edematous that they were opened with difficulty. (4) Joint manifestations, accompanied by fever, pain, swelling and prostration and delirium, lasting a week, and making a total of twenty-seven days after injection. The patient made a good recovery. A somewhat similar case is reported by Boenheim.[4] Following a prophylactic dose of 3.5 c.c. of the serum subcutaneously, considerable itching developed at the site of the injection. In the course of a week the itching over the entire body became so intolerable as to require morphine for its relief. In addition, there was an urticarial eruption, slight fever, and weakness. The day following the administration of the morphine, the pruritus disappeared, leaving in its place pain in the muscles and bones. It is noteworthy that the pruritus was temporarily relieved after the bowels had been moved freely. Boenheim suggests, as a result of this experience, that purgation should be practiced in cases of toxic pruritus.

Benzol. While the exact status of benzol in the treatment of *leukemia* is not definitely fixed, one is probably safe in asserting that, although it is not specific, it is unquestionably a symptomatic remedy of the greatest value; indeed one may go further and state that it is the only remedy with which we can hope to hold the disease in abeyance. Several interesting points have been made during the past year in regard to the

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[1] Münchener med. Wochenschrift, January 5, 1915.

[2] Therapeutic Gazette, January, 1915.

[3] Washington Medicine Annals, January, 1915.

[4] Berliner klin. Wochenschrift, December 21, 1914.

technic of its employment. F. H. Smith[1] states that there is nothing more certain in benzol therapy than this: The practitioner who prescribes the drug without making frequent blood counts is courting disaster. The danger mark in its administration seems to be when the white cell count has dropped to 25,000 or 30,000. At this point the white cells often abruptly fall to 6000 or 7000. Kiralyfi[2] also advises discontinuing the drug as soon as the number of leukocytes begins to decline, and in any case when the count has reached 25,000 or 20,000. He has found that when this point is reached the white cells continue to diminish in number even when the drug is withdrawn. He reports a case in which the blood picture was much improved under treatment, but despite the stoppage of the benzol, the leukocytes continued to diminish to 2800. Severe epistaxis occurred and persisted, despite attempts to check it, for seven days, the patient dying twenty-two days after the remedy was withdrawn. At that time the white count was 460 cm. Stein[3] insists on checking up the treatment by frequent examinations of the blood. He cites a case in which a sham improvement was obtained; that is, there was a marked drop in the number of leukocytes, but this was produced by a total break-down of the blood-making apparatus, with mental disturbances, hemorrhagic diathesis and finally not a trace of coagulation in the blood. The latter condition has been produced experimentally by Hurwitz and Drinker.[4] These observers found that subcutaneous injections of Benzol in rabbits produced marked destructive changes in the hematopoietic organs, especially in the myeloid tissue, and that benzol poisoning registers a change not only in the formed elements of the blood, but also in the factors of coagulation.

Neumann[5] attempted to find some drug or substance which would neutralize or annul the toxic action of benzol. In this he failed, but his experiments demonstrated the peculiarly variable action and effect of benzol, indicating wide differences in individual tolerance. It is this that makes it dangerous, as it is a powerful poison for the leukocytes, and it is not possible beforehand to estimate the extent of its toxic action.

An editorial article[6] states that the good results sometimes obtained with arsenic has been lost sight of since the introduction of benzol. The two drugs may be combined with advantage in some cases.

There is now a good deal of evidence to show that the leukemic process is very materially affected by the employment of the *x-rays*. An ex-

[1] Journal of American Medical Association, May 22, 1915.
[2] Weiner klin. Wochenschrift, 1914.
[3] Medizinische Klinik, February 28, 1915.
[4] Journal of Experimental Medicine, May, 1915.
[5] Deutsche med. Wochenschrift, April 1, 1915.
[6] Merck's Archives, November, 1914.

cellent method is to combine the *x*-rays and the benzol in the treatment. It is said that this method makes it possible to administer much smaller amounts of the benzol. Levison[1] also advocates, when possible, the use of benzol with the *x*-rays. He states that when the drug is not tolerated by mouth, it may be tried subcutaneously or *per rectum*.

Smith[2] reports one case which is of interest because of the length of time it has been under observation. The case was one of the splenomyelogenous type and has been under observation almost continuously for nineteen months. Smith states that the length of the treatment exceeds that of any case of which he has knowledge. Another interesting feature of the case is the age of the patient, a boy thirteen years of age. Leukemia occurring in children has generally been considered as hopeless. When the treatment was started, the spleen occupied about four-fifths of the abdominal cavity, and the leukocytes numbered 499,000. At the end of nineteen months the boy is living, is attending to his school duties, says he feels well and on casual observation would seem so. In spite of the splendid symptomatic results obtained in this case, Smith believes that, sooner or later, in spite of the benzol, if not because of it, the disease will assume one of three forms—a chronic progression upward of the leukocyte curve, a constant enlargement of the spleen and ultimate death, just as if there had been no staying treatment, or an acute fulminant picture in which the increase of the leukocytes will be by leaps and bounds to a high figure; or, on the other hand, a drop in the leukocyte curve will come which will not stop at the normal line, but will continue downward to 500 or thereabouts, with all the other evidences of aplastic anemia.

Stein[3] mentions a case in which the leukocytes dropped under the use of benzol, from 225,000 to 9000, and the differential count became normal. This case was first reported in 1912 as an example of the efficacy of the benzol treatment. She was further treated with arsenic and regained her earning capacity. The white cells were reduced to 2000, and the reds increased. The general improvement kept up for eight months. The woman then died of an intercurrent pneumonia.

Benzoate of Sodium. The attempt of Dr. Wiley several years ago, on behalf of the United States Government, to prove that benzoate of sodium was a poison, and, as such, should not be put in preserved foods, is still fresh in our minds. It will be recalled that an adverse decision was rendered, and that a referee board made up of eminent chemists found that as much as $7\frac{1}{2}$ grains of benzoic acid, or its salts, could be consumed in divided doses throughout the day and that it must be regarded as harmless to the human body. On the strength of this the Government has permitted the use of benzoate as a preservative, provided the facts of such use are stated on the package.

[1] Interstate Medical Journal, June, 1914.
[2] Loc. cit.   [3] Loc. cit.

The German Imperial Board of Health has also investigated the subject.[1] They concur in the previous findings as to the innocuousness of small doses continued throughout a long period, and have shown that the fears expressed by previous experimenters were groundless. They found that dogs could take daily doses of 1 gram per kilogram of weight of the animal for weeks and months without showing any toxic effects. This is the equivalent of over an ounce and a half a day for a man of 110 pounds, a dose which could not possibly be taken in any amount of jam or other preserve that could be eaten in twenty-four hours.

Blood Serum. Following the remarkable observation of Welch that blood serum was the most efficient hemostatic we possess in hemophilic subjects, numerous articles have appeared on the subject during the past few years. Originally blood serum, usually that of the horse, was employed. Later, human serum, whole blood from a healthy donor, and transfusion have been used.

Curtis[2] prefers the subcutaneous injection of *whole blood*, immediately on withdrawal from a healthy donor, *in the treatment of hemorrhage.* In many cases of uterine hemorrhage this procedure obviates the need of operative interference or expensive and time-consuming x-ray treatment. For persistent hemorrhage of moderate severity, for example the newborn, Curtis believes that blood injection rivals transfusion in results obtained, and is the method of choice because it requires little technical skill. In infants with severe anemia, intravenous injection of blood by means of a 100 c.c. lubricated syringe is a worthy substitute for a transfusion operation. In Curtis' opinion, hemotherapy for chronic anemias, wasting disease, and infections with grave outlook, deserves serious consideration. He believes that it is not unlikely that the stimulating effect of repeated injections of blood offers more hope in this field than does the more difficult procedure of one or even two transfusions of large quantities of blood.

A single case of *purpura hemorrhagica* successfully treated by means of whole blood injected subcutaneously is reported by Howard.[3]

Meisen and Fromm[4] report eight cases in which the average coagulation time was 5.18 minutes before the injection of horse serum and 4.12 minutes after the injection, making an average decrease in the coagulation time of 1.06 minutes.

In a case in which postoperative hemorrhage threatens, they advise the use of horse serum prior to the operation. Those subject to the hemorrhage or hemophilia diathesis should be especially protected in this way.

[1] Medical Record, September 19, 1914.
[2] Journal of American Medical Association, January 23, 1915.
[3] Kentucky Medical Journal, October 1, 1914.
[4] Albany Medical Annals, October, 1914.

Hess[1] has published an interesting article on the use of *tissue extract as a hemostatic*. At first hemologous tissue was used—in the case of bleeding in the human, human uterine tissue. In his later experiments, Hess has employed the liver or the brain of cattle. The extract is prepared as follows: The tissue is obtained fresh from the slaughter-house, washed thoroughly free from blood, ground up in a machine, extracted in salt solution in the refrigerator and then filtered. Asceptic precautions are carefully carried out. The extract, which contains some fine suspension of tissue, in addition to tissue juice, is preserved by the addition of 0.3 per cent. of tricresol. Cultures, both aërobic and anaërobic, made from the fluid have been found to be sterile. In addition to the liquid preparation, a powder has been prepared. The powder is made by desiccating the tissue and grinding it up finely in a mortar. The addition of tricresol to the preparations has been found to maintain their potency for at least a month.

Experimentally, Hess has found that the bleeding following a skin incision, or incision into the liver in animals, is quickly checked by the local application of these thromboplastic preparations. Given intra-venously (2 c.c. of a 10 per cent solution injected into the ear vein of a rabbit) it has been possible to shorten the coagulation time by one-half.

In addition to his experimental work, Hess reports two cases of *hemophilia* successfully treated by means of tissue extract.

In one case the bleeding resisted every means tried, including the injection of horse serum. As a last resort, a tissue extract was made from a human uterus just removed. The local application of this extract resulted in almost instantaneous cessation of the bleeding and there was no recurrence.

In the second case the constant oozing from an injury to the tongue was stopped in a few minutes by the application of thromboplastin.

The hemostatic properties of tissue extract have been recognized for some time by surgeons. For instance, the oozing which takes place from minute vessels which can not be ligatured, is readily controlled by crushing a small piece of muscle tissue with hemostatic forceps and applying the crushed tissue to the bleeding-point.

Chaulmoogra Oil. The only remedy that has withstood the test of time in the treatment of *leprosy* is chaulmoogra oil. Heiser[2] reports very good results from the use of the following mixture:

Chaulmoogra oil,
Camphorated oil . . . . āā   60 c.c.
Resorcin   . . . .   4 gm.

The ingredients are mixed, dissolved with the aid of heat on a water bath, and then filtered. The mixture is given hypodermically. The

[1] Journal of American Medical Association, April 24, 1915.
[2] American Journal of Tropical Diseases and Preventive Medicine, November, 1914.

injections are given at weekly intervals. The initial dose is 1 c.c., and this is gradually increased to the point of tolerance. In making the increase in dosage, the object is to avoid too violent reactions. In Heiser's experience, this mixture has consistently given more favorable results than any other he knows of. It produces apparent cures in some cases, causes great improvement in many others, and arrests the progress of the disease in almost every instance. He states that at present he has under observation over twenty patients who have become microscopically negative since they began the treatment. This method is apparently equally efficient in the different types of the disease; the tubercular or hypertrophic, the anesthetic, and the mixed.

Chenopodium. Because of the European war, thymol, which was the most generally used remedy against *hook-worm*, became scarce, expensive and difficult to obtain. As a result, many physicians began to use the oil of chenopodium. There has been a prejudice against the use of this drug owing to its alleged frequent tendency to produce untoward affects and even death. Severe nephritis has been reported by some observers, and paralysis of the central nervous system by others. The account of the oil in the United States Dispensatory is concluded with the following statement: "Oil of chenopodium has in various cases acted as a lethal poison." Levy,[1] in order to obtain further information concerning its toxicology, regarding which the available data are exceeding scanty, has collected from the literature twelve cases in which untoward symptoms followed the use of the drug. An analysis of these cases shows the following points: Eight of the 12 cases occurred in children under thirteen years of age. Nine of the 12 cases ended fatally; in 7 instances, the individuals received what may be considered an overdose; of the remaining 5, the dosage is uncertain in 2.

Levy concludes that oil of chenopodium is an effective vermifuge in the treatment of hook-worm and that, in therapeutic doses, it is non-toxic. It is not unpleasant to take, its ingestion is followed by no disagreeable symptoms and it is cheap. He recommends that the drug be given a thorough trial in the treatment of hook-worm infection.

Levy recommends the following mode of administration: First day: Liquid diet; 8 p.m., 1 ounce of Epsom salt.

Second day: omit breakfast and luncheon; 5 a.m., 1 ounce of Epsom salt; 7, 9, and 11, 16 drops of the oil of chenopodium on a teaspoonful of granulated sugar; 1 p.m., 1 ounce of castor oil containing 50 minims of chloroform. Soft supper.

Third day: Resume full diet.

The treatment may be repeated at intervals of one week until ova can no longer be found in the feces. The worms are usually expelled

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[1] Journal of American Medical Association, November 28, 1914.

in the "castor-oil stool." It is desirable to add the chloroform to the castor oil, as it appears to assist in the narcotization of the worms in their passage through the intestinal tract.

Another method of administration is that employed by Drs. Schüffner and Barrmann (quoted by Heiser, see below) who have treated over 40,000 cases of hook-worm with oil of chenopodium without after-affects and with results superior to those obtained with thymol. On a method based on the number of worms expelled, the chenopodium showed an efficiency of 91 as against 83 for thymol.

Schüffner recommends that the patient be given liquid diet for the evening meal, no breakfast, and then that 16 minims of oleum chenopodii be placed on sugar, divided into three parts, the portions being taken at hour intervals. Two hours after the last dose is administered, he gives 17 grams of castor oil and 3 grams of chloroform. He states, however, that if there is any objection to taking castor oil, it may be omitted, and only a slight decrease in the efficiency will result.

For children, Levy recommends the following doses as advocated by Gockel:

From 6 to 8 years	8 drops
From 9 to 10 years	10 "
From 11 to 16 years	12 "
Over 16 years	12 to 16 "

Heiser[1] states that in the Orient the oil of chenopodium has been very extensively employed against the hook-worm and other intestinal parasites. Physicians of the Orient have recently treated, with oil of chenopodium, over 100,000 cases of hook-worm of both the old- and new-world type, with greater success than with remedies heretofore employed and with practically no untoward effects.

In Sumatra, where the worst cases were treated, the physicians state that the oil of chenopodium is also one of the best drugs against the *round-worm*, *tape-worm*, and *whip-worm*.

Chloride of Ammonium. In the treatment of inflammatory affections of the bronchi, whether acute or chronic, it is the almost universal custom to prescribe some one of the so-called expectorant drugs. In spite of the many years these agents have been employed, either singly or in combination with other drugs, their value has always been problematical. My own experience with "acute colds" has taught me that they are but little influenced by medication, and, whether treated or untreated, they tend to run a course of from one to three weeks. They may be aborted within the first few days if the patient is kept at rest in bed. Once they become established they are little influenced by medicine. Among city dwellers, a few days at the seashore will often clear up an obstinate "cold" like magic.

[1] Journal of American Medical Association, August 7, 1915.

Miller[1] has contributed a study on expectorants. He defines expectorants as agents which facilitate the removal of secretion from the air passages. To facilitate the removal of mucus it is necessary to stimulate coughing, increase the ciliary movements, lessen the viscosity of the secretion, or stimulate bronchial peristalsis. Miller states that it is highly improbable that any of the expectorants increase the ciliary movements, and there is no evidence that any of the expectorants increase the rhythmical muscular contraction in the bronchioles. It is possible, however, that apomorphine in large doses may stimulate the vagus and thus increase peristalsis. The final possibility is that the expectorants may thin the bronchial secretion. This may be accomplished either by increasing the amount of secretion or by introducing into the secretion something which would dissolve the mucus, as, for instance, an alkali. The expectorant action of ammonium chloride and carbonate was once thought to be due to their elimination through the bronchial mucosa, the alkali thinning the secretion. This theory, Miller states, will not bear close scrutiny, and it is now believed that their action is upon the bronchial gland centre, which, in its activity, apparently shows a parallelism with the salivary centre.

His conclusions are that ammonium chloride and ammonium carbonate and the emetic group of expectorants, as apomorphine and ipecac, when given in sufficiently large doses to animals, increase bronchial secretion. Ammonium salts, by mouth, in moderate doses equivalent to 2 mg. in an adult man, do not increase bronchial secretion in the dog. Apomorphine and emetine when given to dogs in doses considerably greater than the ordinary therapeautic dose for man, do not excite increased bronchial secretion.

Cod-liver Oil. The great vogue enjoyed by this agent a generation or so ago is familiar to all. At one time it was the remedy of choice in all diseases characterized by wasting, among which tuberculosis and the malnutrition of infants and young children, are the most notable examples. That cod-liver oil did good in these cases there can be no doubt, but we have finally come to the realization that it was as an easily assimilable fat that it did good, and not because it was possessed of specific powers not possessed by other fats equally assimilable. In spite of this knowledge, many of the pharmaceutical houses are putting out cod-liver oil preparations for which the claim is made that they are odorless and tasteless, but still retain all the virtues of the original oil. Street,[2] in an excellent study of these so-called cod-liver oil cordials points out that the practise of producing a tasteless oil has been carried to such extremes that many of these preparations have had the oil removed entirely and only the name remains.

His investigation of a number of the preparations now on the market

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[1] American Journal of Medical Sciences, October, 1914.
[2] Journal of American Medical Association, February 20, 1915.

clearly indicated that they were all inferior to the true oil, and that they had little to recommend them.

An editorial[1] comment on the subject very pertinently remarks that "There seems to be no reason, therefore, for calling on the shelves of the druggist to supply the nutrient virtues which are found in cream and butter and eggs that are a welcomed component of the dietary of persons of all ages. When cod-liver oil might be 'indicated,' it is quite as rational, certainly cheaper, and admittedly less distasteful, to supply these common food products. Above all, let us keep foods and drugs apart; each group has its field of usefulness, but the 'combinations' are likely to have no more justification or merit than the extravagant mixtures of antiquated polypharmacy."

It is thus apparent that cod-liver oil has been supplanted by other forms of fat which are equally useful, and, in addition, are free from the disadvantages of the oil. It is worth while recalling, however, that cod-liver oil can still be used to advantage in the form of inunctions. Several years ago I reviewed an article on this use of the oil in the treatment of malnutrition in infants. Since then my own experience has taught me that the method is one of the most valuable we possess. Given a child whose digestion is such that it either cannot retain food, or, if retained, cannot digest it properly, innunctions of cod-liver oil into the abdominal wall will often save life. The only objection to the treatment is the odor which the wearing of an oil-soaked bandage gives rise to. I am indebted to Dr. T. S. Wescott for a method which will do away with this objection. He advises a combination of cod-liver oil, two parts, and liquid soap, one part. The liquefied soap aids in the absorption of the oil which can be quickly rubbed into the skin.

Corpus Luteum. In Progressive Medicine for last year I referred to an article by Dannreuther on the use of the extract of corpus luteum in the treatment of menstrual disorders. Seitz, Wintz and Fingerhut[2] have contributed an article on this subject. According to these observers, menstruation is dependent on the function of the corpus luteum which consists of two substances, luteolipoid and lipamin, a lipo-proteid. The first has hemostatic properties, and, if introduced subcutaneously before and after menstruation, will reduce the flow and shorten the period. The second substance or lipamin in animal experiments stimulates the development of the genitals and, if injected into amenorrheic subjects, will induce menstruation.

The therapeutic effect of the luteolipoid is excellent in hemorrhage occurring at puberty, as well as in menorrhagia of non-organic origin. In climacteric hemorrhages, it is of value only in the presence of retarded blood coagulation, and is useless in hemorrhages of an inflammatory nature. If given in case of hemorrhage due to a myoma, it

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[1] Journal of American Medical Association, February 20, 1915.
[2] Münchener med. Wochenschrift, August 4, 1914.

produces a temporary increase in the flow. In dysmenorrhea accompanied by profuse bleeding, it eases the pain.

They state that the second substance (lipamin), if persistently used, will induce menstruation in amenorrheic patients. In dysmenorrhea accompanied by a scanty flow, injections of lipamin, if given before the monthly period, will not only alleviate but prevent pain. Based on their animal experiments, Seitz, Wintz and Fingerhut believe that it would be perfectly justifiable to attempt to correct hyperplasia of the genitalia by prolonged injections of lipamin.

Crotalin. The unsatisfactory results obtained with the established methods of treating epilepsy undoubtedly have much to do with the prominence given to any new method of treatment. Occasionally, as in the case of crotalin, the remedy achieves a reputation it does not deserve. In last years' PROGRESSIVE MEDICINE, I quoted several articles condemning its use.

Thom[1] placed 14 cases of idiopathic epilepsy on the crotalin treatment with the intention of continuing it for three months. It was necessary to suspend the treatment in 3 of the cases; in 1, because of the development of hysteria attacks; in a second, because of the marked increase in the frequency and severity of the convulsions; and, in the third, because of such violent local and systemic reactions that Thom did not feel justified in continuing its use. Of the remaining 11 cases which were kept under treatment for three months, 6 became worse and 4 showed no change whatever. One, a typical case of hysteria epilepsy, showed improvement, due, in Thom's opinion, to a psychological effect of the administration rather than to the crotalin.

In addition to his own cases, Thom collected in all 58 cases. Six, or less than 10 per cent., showed improvement; 20, or more than 35 per cent., became worse, and 3 died while the treatment was being carried out. The remaining 29 cases apparently were unaffected by the drug.

Diet. One of the most signal advances in the management of a disease which has hitherto taxed the resources of the physician, is the so-called starvation treatment of *diabetes mellitus*.

The credit for the introduction of this plan of treatment must be given to Frederick M. Allen, of the Rockefeller Hospital. It was he who first demonstrated the possibilities of the method by means of animal experimentation and later had the courage to apply it in human beings. As was very aptly remarked by Joslin, himself one of the foremost authorities on diabetes, it is now possible to treat the diabetic and not nurse him.

Allen[2] maintains that diabetes is not a disease but merely the weakness

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[1] Boston Medical and Surgical Journal, December 17, 1914.

[2] Ibid., February 18, 1915; Journal of American Medical Association, September 12, 1914.

of a bodily function, namely, the function of assimilating certain foods. His hypothesis is to stop the glycosuria by fasting, and then furnish a diet which will support life without producing glycosuria. He first demonstrated, experimentally, that diabetic dogs could be freed of their glycosuria, and then, by a low diet gradually increased, kept sugar-free. Such an animal is thin, but strong and lively, with no cachexia and no sign of downward tendency. One result of the starvation period is some loss in weight. This, however, is negligible. The attempt to put on weight, Allen says, is one of the surest ways of bringing back all the symptoms and sending the patient down hill. In his opinion, it is probably one of the chief causes of past failures in treating severe diabetes.

The plan to be pursued is briefly as follows: When the patient first comes under observation he is kept on the ordinary mixed diet and daily analyses made in order to determine the amount of the urinary output, the percentage of sugar and the amount of ketonuria. Of course, if the patient's condition is desperate when first seen, active treatment should be instituted at once. The initial step is to fast the patient until the sugar disappears, this may take from two or three to ten days. In a somewhat limited experience, I have found that three days suffices to free patients from their glycosuria even in those with a high percentage of sugar. During the fast period the patient receives no food whatever. Alcohol in moderate doses can be given if desired. Its use or omission depends on individual conditions, but, as a rule, its use is advisable as it has some food value and is said to diminish ketonuria. If coma threatens, its use is particularly desirable. Alkalies may also be given if there is danger of coma, but afterward they are no longer needed.

As the result of the fasting, the sugar rapidly diminishes, and, at the same time, the ketonuria falls rapidly until it quickly approximates what a normal individual would show under similar conditions. The ultimate aim is to keep the ketonuria down to their level. The fasting period is continued for from twenty-four to forty-eight hours after the sugar has disappeared.

The next step is to begin feeding very slowly and cautiously. There is no fixed program. The one requirement is that the patient must remain free from both glycosuria and acidosis. Any trace of sugar is the signal for a fast day, with or without alcohol. While the original fast may be anything from two to ten days, the succeeding fasts necessitated by small traces of sugar need be no longer than one day.

The things to be considered in the diet are carbohydrate, protein, fat, and bulk. As a rule, the first thing given after the fast is carbohydrate. While no distinction is necessary between the different forms of starch, there are advantages in using vegetables. The first day after the fast the only food may be 200 gm. of vegetables of the 5 and 6 per

cent. classes. The amount is increased day by day until a trace of glycosuria appears, which is checked by a fast day. The purpose of this program is to ascertain the carbohydrate tolerance and to clear up the last traces of acidosis. Following this carbohydrate period, or sometimes in place of it, protein is given. On the first day one or two eggs are given, and nothing else. More protein, generally in the form of eggs and milk, is added day by day, until the patient either shows glycosuria or reaches a safe protein ration. The purpose here is to learn the protein tolerance, and to cover the protein loss as quickly as possible. Fat is less urgently needed, except in very weak and emaciated patients; it can be added gradually as conditions seems to indicate.

An important feature is the element of bulk in the diet. This is necessary in order to give a comfortable feeling of fulness and to prevent constipation. For this purpose, green vegetables are very valuable. When they are fed raw, or cooked in steam, or boiled and evaporated so that no water is thrown away, they contain a definite quantity of carbohydrate besides valuable salts; and this is the only form of carbohydrate that patients thus treated ordinarily receive. In very severe cases, even green vegetables cannot be tolerated. In such cases the vegetables may be boiled three times, throwing away all the water. In this way nearly all the starch is removed, and, as a rule, patients take these thrice-cooked vegetables gladly and without glycosuria.

In very severe cases it is necessary to restrict all classes of food, and to carefully test the tolerance of each patient for each particular class of food. Carbohydrate is given, if possible, but is kept safely below the limit of tolerance. Protein must also be kept fairly low, sometimes very low. If the protein tolerance is low, the rule is to exclude all carbohydrate and feed as much protein as is possible without glycosuria.

Whether this method will actually cure, remains to be seen. That it will quickly free the majority of diabetics of their glycosuria has been amply demonstrated. One need only to try the plan to be convinced of its efficiency and the relative ease with which it is carried out. Furthermore, the fasting does not produce serious results. Even moribund cases can be starved, and also those with serious complications, such as gangrene, carbuncle, etc. Allen states that fasting is the most efficient method of controlling the carbuncle complicating diabetes.

My own experience has been confined to hospital cases. Several have been of very low intelligence and yet no difficulty was experienced in getting them to submit to the treatment. I believe it is preferable, whenever possible, to carry out the early stages of the treatment in a hospital. Not only is the control of the patient better, but, in addition, the necessary chemical analyses are more easily obtained. After the patient is freed of sugar and thoroughly instructed as to his dietetic

requirements and mode of life, he may be allowed to return to his home. Joslin instructs his patients to test their own urine for sugar, and, if any is present, to report to him at once.

Fasting has also been used as a therapeutic measure *in the treatment of obesity.* Folin and Denis[1] report observations made on two extraordinarily fat women, both essentially normal except with reference to their obesity. In carrying out their study, the metabolic effects of starvation were carefully studied, the analyses including practically all the determinable urinary constituents. The results obtained suggest that a safe, rapid and effective method of reducing the weight of very obese persons is by a series of repeated fasts of increasing duration. The length of each fast is determined by using the ammonia or β-oxybutyric acid elimination as a guide. The method is applicable only in the hands of one with the requisite chemical training.

The length of time it has taken to bring about a change in the *method of feeding typhoid fever* patients illustrates very well how deep-rooted certain opinions become and how difficult it is to shake off the shackles of orthodoxy. "Stuff a cold, starve a fever" has been accepted as the proper procedure for so long that many are loth to make a change. Eighteen years ago, Hare, in an editorial comment, raised the question as to whether the rigid adherence to a milk diet was good practice. From clinical observations, he had become convinced that such a diet was not only not necessary but actually harmful. A few years later, Shattuck reported a series of cases of typhoid fever in which he had employed a liberal mixed diet with advantageous results. Dating from this time the number of clinicians who have abandoned the milk diet in favor of more liberal feeding has steadily increased. As Barker[2] says, it is no wonder that predjudice against a more liberal diet should be deep-seated, if we recall the past history of the dietetic treatment of typhoid fever. This prejudice is increased by false ideas regarding the character of the intestinal contents in typhoid and their relation to ulcers. According to the old ideas, hemorrhage, perforation and relapse, in typhoid were often ascribed to dietetic errors because they sometimes followed them. As Barker states, there are physicians in practice today who still believe it almost criminal to permit a typhoid patient to eat a piece of dry toast, even when it is thoroughly masticated. Perforation will occasionally occur, it is true, after a patient has eaten dry toast, but this observation is far from establishing a causal relation between the two events.

Another objection that was offered to a liberal diet was that the administration of large amounts of food during the febrile stage of typhoid fever might cause too great an increase in heat production, and, in turn, a rise in temperature. This theoretical objection has been

[1] Journal of Biological Chemistry, May, 1915.
[2] Journal of American Medical Association, September 12, 1914.

disposed of by Coleman and Du Bois[1] who showed that only a slight, if not negligible, increase in heat metabolism occurred.

The diet employed by Coleman and Du Bois[2] in their studies was as follows: By the end of the first week their patients were usually taking a quart of milk, a little less than a pint of 20 per cent. cream, 3 to 6 ounces of lactose, 2 or 3 eggs, a couple of slices of toast and from $\frac{1}{2}$ to 1 ounce of butter. This provides the patient with from 2000 to 3000 calories. In a short time an additional 1000 calories are gradually provided by giving rice, oatmeal, mashed potatoes, cream of wheat, apple sauce, custard and ice-cream.

For years emaciation was accepted as one of the inevitable consequences of the disease and losses in weight, sometimes amounting to 30 or 40 per cent. were complacently accepted. Furthermore, the disinclination of the patient to take food and the belief that food could not be well digested and assimilated in the course of high fever contributed to keep the food intake low. The real bugbear, however, was the firmly established belief that the risks of hemorrhage and perforation were enormously increased if solid foods were used.

In common with all others who have adopted a more liberal diet in the feeding of typhoid patients, Barker states that the great gain consists in the lessening of emaciation, the shortening of convalescence and the prevention of exhaustion phenomena after the disease has run its course. Barker also believes that since convalescence can be shortened and emaciation prevented, there is good reason to believe that post-typhoidal psychoses and post-typhoidal neurasthenic states will be less common than under the old regime. And while it is a little too early to speak positively regarding this point, his clinical impression thus far favors the view stated.

Torrey[3] has published an extremely interested study which furnishes additional evidence in favor of a more liberal diet in the treatment of typhoid fever. Torrey undertook the task of correlating the conditions and changes in the intestinal flora of human subjects in connection with the constitution of the diet employed. The subjects of this investigation happened to be the typhoid fever patients under Coleman, and placed on the "high calory" diet already noted above.

Torrey found that the stools early in the course of the disease indicated that the intestinal flora in such patients is not uniform or specific in type, but exhibits variations such as may be observed in a series of supposedly normal individuals. The conclusion to be drawn from this is that the character of the intestinal flora is not a factor concerned in the determination of susceptibility to typhoidal infection.

On the "high calory" diet, Torrey noted that the intestinal flora tended to become simplified in regard to the variety of bacterial types

[1] Archives of Internal Medicine, August, 1914.   [2] Ibid.
[3] Journal of Infectious Diseases, 1915, xvi.

observed. The degree of transformation was dependent largely on the type of flora which was present at the onset of the disease. When the bacterial flora showed a definite putrefactive tendency, the change brought about by the "high calory" diet did not extend further than the elimination of the obligate putrefactive organisms and a moderate development of the acidmic types. But, when the initial flora was of a more favorable character, the change was of so radical a nature that the stools finally resembled those of normal infancy.

In comparing these results with those obtained when milk was the chief element in the diet, it is interesting to note that this food alone did not bring about the transformation of the intestinal flora to such a degree as that which may follow more liberal carbohydrate feeding. Clinically, it was noted that patients liberally fed enjoyed comparative freedom from the distention attending the putrefactive type of bacteria and that the disease showed a tendency to run a mild course.

La Fetra and Schroeder[1] have reported a series of children suffering from typhoid fever in whom a high caloric diet was employed. The children were fed at three-hour intervals, beginning at 6 A.M. and ending at 9 P.M., making six feedings in the twenty-four hours. They used articles of food such as would be given to a child in health, with the exception that the only meat used was creamed chicken. Lactose, coca and usually cream were added to the milk in order to increase its caloric value. Cereals were given to nearly every child, and eggs and toast were offered from the onset of the illness. While no fixed rule was made in regard to the amount of protein, they saw to it that the number of protein calories was not less than 7 or over 15 per cent. of the total number of calories given. As a result of their experience, they found that, besides presenting emaciation, the high calory diet greatly increases the comfort of the child, prevents severe nervous symptoms and lessens the danger of the disease and of its complications.

Rissmann[2] asserts that about two-thirds of all *pregnant women* suffer more or less from changes in metabolism, and that such changes should be regarded as being pathological as much as the changes which occur in a person with gout or diabetes. With the first intimation of trouble, dietetic changes should be instituted at once. In order to minimize these dangers, meat and stimulants should be used sparingly, and the stomach should never be overloaded. Constipation should not be allowed. By this means, supplemented with ovarian extract and salts, the patient may be carried along without the condition becoming so serious as to bring on eclampsia.

Rissmann declares that eclampsia never occurs without warning signals; the residual nitrogen is abnormally high, there is also retention of sodium and generally also of potassium.

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[1] American Journal of Diseases of Children, May, 1915.
[2] Medizinische Klinik, April 11, 1915.

Digitalis. An excellent article on the newer ideas concerning digitalis has been contributed by H. C. Wood, Jr.[1] He first calls attention to the fact that many of our conceptions regarding the action of this drug are based on faulty experimental evidence. This has been brought about largely by reason of the fact that experimental evidence has been obtained by the employment of doses far in excess of those which could ever be employed in practical medicine. As a result, it is not strange that pharmacologists have reached some erroneous conclusions concerning the therapeutic effects of digitalis.

Wood states that the characteristic results which have been attributed to digitalis are: A reduction of the pulse-rate through stimulation of the inhibitory mechanism; an increase in the force of the contractions of the heart; and a narrowing of the lumen of the bloodvessels by an action both directly upon the unstriped muscle and upon the vasomotor centres in the medulla.

It is now well recognized that digitalis does not raise the blood-pressure. Despite the fact that the drug does not raise the blood-pressure, Wood believes that it has some effect on the vasomotor system. There are two facts in favor of this: (1) Fraenkel found that if he abolished the slowing of the pulse by the administration of atropine, strophanthus caused, in the normal man, a marked increase in the arterial pressure. (2) There have been studies made which make it highly probable that the diuretic action of the digitalis group is due to a relative dilatation of the bloodvessels in the kidney and this local vascular relaxation may occur simultaneously with a contraction of the arteries of the splanchnic area.

The most constant and the earliest apparent effect produced by relatively small doses of digitalis is slowing of the pulse. Wood does not believe that digitalis has any effect whatever on the heart muscle, but that the slowing of the pulse-rate is purely inhibitory, except after very large doses. In this he will probably find a number of observers who will disagree with him, as there is very good evidence to prove that the muscle is directly influenced by the drug.

Wood summarizes the action of small doses of digitalis upon the normal circulation as a stimulative of the cardio-inhibitory mechanism with probably a slight increase of vasomotor tone, but not sufficient to cause any rise in the blood-pressure. The increased vigor of contraction and muscle tone due to a direct action upon the heart muscle, while perhaps manifestations of the action of therapeutic doses, are later phenomena than the retardation of the pulse-rate.

As Wood points out, the effects of digitalis in disease are often very different from those produced in health. It has long been recognized, for instance, that fever has a very decided modifying influence on the

[1] Therapeutic Gazette, June, 1915.

effects of digitalis and that little, if any, effect is to be expected if pyrexia is present.

One of the most interesting and important contributions to the study of heart disease has been the pioneer revelations, partly by Mackenzie and partly by Cushny, as to the causes of rupture compensation. As is well known these observers have shown that in many cases of severe heart-failure the auricle ceases to contract coördinately, passing into a condition known as fibrillation, in which each muscle fiber contracts without any relation to its fellows. In his analysis of the causes of heart-failure, Mackenzie differentiates sharply between the action of digitalis in those cases in which the auricle is fibrillating and those in which it is beating coördinately. While the most marked effects of digitalis are seen in the first group, Wood condemns the view that digitalis is a specific in all cases of auricular fibrillation, but useless in all other forms of chronic heart disease and that the fact that digitalis exercises a beneficial influence is of itself evidence that the case is one of auricular fibrillation. Mackenzie, on the other hand, clearly states that certain cases of auricular fibrillation are not apparently benefited by digitalis nor any of its congeners, and in a considerable proportion of his cases of valvular disease, with normal rhythm, decided improvement followed the exhibition of the drug.

Wood protests against the practice of administering digitalis in large doses until marked evidence of toxic effects are produced, such as nausea and arrhythmia. He believes that the proper method of using the drug is to employ a dose which will accomplish the desired result and that there are many cases which might be benefited by small doses in which very large doses may prove actually harmful. Therapeutic boldness is an important medical virtue, but rashness is always a fault; it is as grave an error to habitually overdose our patients as it is to underdose them.

Emetine.   The literature on this drug is, as in the past three or four years, quite extensive. There are, however, fewer articles dealing with its action in cases of *amebic dysentery*. Among the latter may be mentioned those of Lyons,[1] Phillips,[2] and Haines.[3] Lyons's contribution is an excellent review of the present status of the drug and may be considered as representing, at least for the present, the last word on the subject. His conclusions are summarized as follows:

1. Ipecac and emetine, when taken by needle or mouth, act through absorption into the blood stream and exert their specific effect only on those entamebas within reach of the circulation, that is, in the tissues. Entamebas free in the lumen of the gut are apparently not affected by either the oral or subcutaneous use of emetine or ipecac.

[1] American Journal of Medical Sciences, July, 1915.

[2] British Medical Journal, December 19, 1914.

[3] Boston Medical and Surgical Journal, November 26, 1914.

2. It is not definitely known how, or in what form, ipecac and emetine are eliminated from the body, but there is some experimental evidence that the amebicidal principles of ipecac (emetine), when taken by mouth, are not eliminated in the feces.

3. The failure of the emetine by needle to destroy the vegetative *entameba coli*, a parasite simply harbored in the intestinal canal, argues against the elimination of the drug from the circulation by way of the large intestines.

4. Relapses are due to the survival of some of the entamebas probably through encystment. There is reason to believe that, in the majority of relapses, some of these cysts remain embedded in the tissues of the gut, only awaiting favorable conditions to become vegetative.

5. In the carrier state, the entamebas are probably simply harbored in the lumen of the gut in the same manner as the coli, thereby causing no symptoms. The intestinal mucosa is in some way protected against the penetration of the organism.

6. Emetine is best administered subcutaneously. Small, repeated injections are to be preferred, as they are more rapidly absorbed and the effect is maintained. In some cases, emetine should be used intravenously.

7. The oral administration of emetine is not advisable because of the intestinal irritation that results. The whole drug is preferable for this route. For the same reason, emetine is not suited for colonic irrigations.

8. In an ordinary case of amebic dysentery, an average dose of 1 grain daily, or less, is sufficient. The duration of the treatment is from one to two weeks. Too large doses or too prolonged use of moderate doses may cause a diarrhea or be responsible for its persistence. There is increasing evidence that large doses of emetine are not without ill-effect.

9. In order to prevent relapses, an intermittent form of treatment should be instituted in every case, even though cysts are not found.

10. Emetine, subcutaneously and locally, has been shown to be practically specific in pyorrhea alveolaris.

11. The use of emetine in hemorrhagic conditions is entirely empirical and its value is questionable.

DeLauney[1] reports a very obstinate case of amebic dysentery which had been treated unsuccessfully with both emetine and ipecac given separately. He then determined to combine the two methods. In order to prevent the ipecac from coming in contact with the stomach, it was put up in capsules previously soaked in formaldehyde to render them insoluble in an acid medium. Number 00 gelatin capsules were soaked for a few hours in a 20 per cent. solution of formaldehyde and then dried, and although they became very brittle and somewhat

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[1] Military Surgeon, October, 1914.

distorted, they could be filled. Each capsule contained 1 gram of powdered ipecac. The treatment with the combined method consisted of giving 1 gram (15 grains) of the ipecac three times daily, and emetine $\frac{1}{3}$ grain twice a day for three days and then increasing it to $\frac{2}{3}$ grain for six days. The patient improved very rapidly, the stools being quickly reduced to one a day. The patient also gained five pounds during the treatment.

Hebbert's[1] views are somewhat different from those of most observers. He seems to have had the unique experience of having had very few cases of amebic dysentery. He states that out of many hundreds of cases of dysentery he has had to resort to ipecac but twice. Hebbert advocates the following method of treatment: He gives 1 dram of *magnesium sulphate* every hour for three days. If the condition is not materially improved by this time, he resorts to rest for one day, with 30 minims of *camphorodyne* at night. The administration of magnesium sulphate is then resumed. Under this routine he has failed to get rid of all blood and mucus in less than two weeks, except in 2 cases only.

In Hebbert's opinion when the colon is very acutely inflamed, as perhaps from some local ulcer, severe spasm takes place, so that complete flushing of the large intestine is prevented.

A year ago Schmitter[2] reported 6 cases of *sprue* which were successfully *treated with emetine*. The drug was given hypodermically in $\frac{1}{2}$ to 1 grain doses daily for five days. Since then, he[3] has observed 2 more cases and 4 have been reported to him by his colleagues. Rogers[4] also reports 2 cases of sprue in which injections of emetine were successful. He gave, in addition to the emetine, a streptococcal vaccine made from the organisms isolated from the mouth lesions.

Renault[5] has employed *emetine in the treatment of cholera*, and although the number of cases treated in this way was not large, he feels that his results warrant a more extended trial. Even if the emetine is given, Renault states that other methods of treatment ought not to be neglected, *e. g.*, astringents to control the diarrhea, and stimulants, such as camphorated oil, caffeine, etc.

Prior to the publication of Renault's paper, Rogers[6] had also tried the effect of emetine injections in the treatment of cholera. After 32 cases had actually received emetine injections, the treatment was stopped, as no obvious benefit had resulted from it. Rogers' criticisms of Renault's observations are that he omitted to take the precaution of having control cases; that he began the treatment when the epidemic had reached its

[1] Indian Medical Gazette, September, 1914.
[2] Military Surgeon, April, 1914.
[3] Journal of American Medical Association, January 2, 1915.
[4] Lancet, June 6, 1914.
[5] Indian Medical Gazette, July, 1914.
[6] Ibid., January, 1915.

height, that is, just when a decline in the virulence would naturally take place; and, finally, that the cases which received the treatment were selected and that the severest cases were excluded. From a study of the factors which influence the mortality in cholera, Rogers concludes that injections of emetine have no influence for good or evil on the course of the disease.

Axten-Hasenfeld[1] reports a case of severe diarrhea due to the *Balantidium coli* which was *cured by the use of emetin*. The patient had as many as twelve watery stools daily, containing pus and blood. Failing to obtain any improvement with other forms of medication, emetine was given hypodermically in the dose of 0.03 gm., and continued for eight days. Within the first twenty-four hours, there was a distinct improvement. After the third injection, the balantidia could no longer be found in the stools.

For the past few years lesions involving the teeth and gums have attracted a great deal of attention, not only because of their local effects but also because of various and systemic affections to which they give rise; and, of these secondary affections, the most important is arthritis. The result has been that an increasing amount of work has been done in the investigation of buccal lesions, particularly *pyorrhea alveolaris*. One of the most important contributions on this subject has been made by Barrett, of the Dental Department of the University of Pennsylvania, and A. J. Smith,[2] Professor of Pathology in the Medical Department of the same institution. These investigations have demonstrated that the most important, if not the sole cause of pyorrhea alveolaris, is an ameba. This they believed to be the Ameba coli. Still more important was the use of emetine in this infection. Barrett and Smith found that emetine had the same specific effect in pyorrhea alveolaris that it had when the protozoan attacked the intestinal mucous membrane.

Following the publication of their results, the subject has been investigated by many others and at the present time it is generally conceded that the amebæ, if not the only cause, are certainly, in many cases, the chief offenders in the production of pyorrhea.

Smith, Middleton and Barrett[3] have also shown that the crypts of the tonsils often harbor the amebæ. In 5 out of 17 cases of diseased tonsils this organism was obtained.

Bass[4] who has investigated the role played by the ameba states that the cause of pyorrhea alveolaris is not the Ameba coli but a separate and distinct species which he calls *Amebæ buccalis*. This is, however, a non-essential fact as emetine is equally deadly for both.

[1] Münchener med. Wochenschrift, 1915, lxii.
[2] Dental Cosmos, August, 1914.
[3] Journal of American Medical Association, 1914, lxii, 1746.
[4] Science, December 4, 1914.

As a preventive of this very prevalent disorder, Bass recommends placing a drop or two of fluidextract of ipecac on the tooth-brush every time it is used. When the disease is present, this should certainly be a routine procedure.

Bass and Johns,[1] in a contribution on the specific treatment of pyorrhea, state that they have not attempted to inject the emetine directly into the pus pockets, as advocated by Smith and Barrett, but have employed the drug hypodermically and by mouth. They found that the hypodermic injection of half a grain of emetine was usually sufficient, although, in special instances, a larger amount was sometimes needed. The amebæ disappear from all lesions following from one to three days of treatment in more than 90 per cent. of the cases. They disappeared in 99 per cent. of Bass's and Johns's cases following at least six days of treatment, and none have had more than six. For the great majority of cases, they recommend the hypodermic injection of emetine hydrochloride each day for from three to six days, depending on the case and the stage of the disease.

Bass and Johns state that, coincidently with the disappearance of the amebæ, the soreness, pain or discomfort and the amount of pus formed rapidly decrease. The tendency to bleed from slight trauma usually ceases within forty-eight hours, and in almost all cases the patient recognizes, and feels confident of, the beneficial effects within a few days. They state, that if a physician feels skeptical as to the specific beneficial effect of emetine, he can remove his skepticism by treating and observing a few patients.

Bass and Johns have also experimented extensively with preparations which can be taken by mouth. As a result of their experience they believe that, in most instances, as good results can be obtained by alkaloids given by mouth as by the hypodermic. This will make the treatment both more available and more practical.

The preparation they employed for internal use is known as Alcresta ipecac. This is a combination of ipecac and aluminum silicate (fuller's earth). It was discovered by Lloyd (see *Kaolin*) that fuller's earth, or kaolin, has the property of removing all the alkaloids from neutral or acid-aqueous solutions of a drug by absorption. Thus, when an alkaloid is combined with kaolin the alkaloid is promptly set free in an alkaline solution. It is not liberated in the gastric juice, but is set free and absorbed when it reaches the alkaline intestinal juice. The so-called Alcresta ipecac in the form of tablets, each representing 10 grains of powdered ipecac, is, according to Bass and Johns, the only preparation of ipecac having this property. It will be recalled, however, that De Launey[2] obtained the same effect by putting the ipecac in gelatin

[1] New Orleans Medical and Surgical Journal, February, 1915; Journal of American Medical Association, February 13, 1915.

[2] Loc. cit.

capsules which had been soaked in formaldehyde, thus rendering them insoluble in the stomach, but readily so in the intestines.

Bass and Johns employed the Alcresta ipecac in doses of from one to three tablets three times a day. One tablet three times a day does not destroy the endamebas in the mouth in many cases in a week or ten days. Two tablets three times a day destroy all demonstrable endamebas in six days or less, in practically all cases. Two tablets three times a day represents about $\frac{2}{3}$ grain of emetine. Three tablets three times a day destroy all demonstrable endamebas in from four to six days.

This form of ipecac does not cause nausea; but there is frequently more or less abdominal discomfort produced by it and also some looseness of the bowels. These symptoms were not sufficiently severe, however, in any of their cases to make the treatment impracticable.

Relapses occurred in about 12 per cent. of Bass's and Johns's cases within four weeks when the treatment with emetine was given. If this happens, the treatment should be repeated. They insist that it should be understood that no case is to be considered cured until the endamebas have disappeared and until all the lesions have healed and the pyorrhea has stopped entirely. Those who expect to accomplish this result in a few days will surely be disappointed in most instances.

In addition to the specific treatment, local dental treatment should be carried out, such as cleaning and scaling the roots, removing dead and denuded alveolar processes and cleaning out large pockets of pus. Frequently irrigating the pockets with a solution of fluidextract of ipecac (one drop to four ounces of water) is suitable for this purpose. Patients can be taught to do this themselves. The Berlin abscess syringe is recommended. Bass and Johns summarize their results as follows:

1. Pyorrhea dentalis and alveolaris is practically a universal disease which leads to the loss of the teeth by a long suppurating process. All people have it sooner or later. It begins in early adult life or earlier.

2. The specific cause of the disease is Endameba buccalis and possibly other species, which infect and destroy the peridental membrane. The pyorrhea results largely from the secondary infection.

3. The demonstrable endamebas can be destroyed by giving $\frac{1}{2}$ grain of emetine hydrochloride hypodermically for three to six successive days.

4. An apparently equal endamebacidal effect is produced by two or three Alcresta ipecac tablets (Lilly) taken by mouth three times a day for four to six successive days.

5. The lesions require variable lengths of time to heal, but many could not reasonably be expected to heal in less than several weeks or months.

6. The treatment must be repeated from time to time until the lesions all heal, on account of relapse or probably reinfection of the lesions as a result of the great prevalence of the infection.

7. Injecting ipecac or emetine into the worst lesions ought to be of service and can be carried out by patients in many instances.

8. Rinsing the mouth thoroughly with a solution of fluidextract of ipecac is believed to protect, to some extent, against reinfection, and actually cures the disease in its earliest stage in some instances.

Allen,[1] in an experience with emetine covering five months, noted an improvement in 77 per cent. of his cases, although an actual cure was obtained in only 35 per cent. He injected $\frac{1}{2}$ grain of emetine hydrochloride daily for six days. If, at the end of six days, the smears still showed amebæ present, three more injections were given. Nine injections were the most given. In 3 cases the injections caused so much local pain that Alcresta ipecac tablets were given instead. The dose of the latter was two tablets three times daily. In addition, Allen employed antiseptic mouth washes and the local application of trichloracetic acid or tincture of iodine.

T. S. Smith,[2] a dental surgeon, does not fully accept the emetine treatment nor does he believe that the endamebas are the sole cause of pyorrhea. He does not believe that the condition can be cured until the pyorrheal pockets have been entirely obliterated. I believe that most medical men will agree that the treatment of pyorrhea alveolaris should be carried out with the coöperation of a competent dentist, and that the proper local treatment should be entrusted to his hands. This may consist, as Smith suggests, of extraction of a tooth; removal of the separated supporting structures to the level of the floor of the pocket; or by the vital reattachment of these tissues to the cementum.

As to the action of ipecac and emetine on the amebæ, the evidence seems already sufficient to consider this method of treatment practically specific.

Among the uses to which emetine has been put is the control of hemorrhages. Lyons,[3] in his summary of the uses of ipecac and emetine, states that it is very questionable whether the drugs are of any value under these circumstances. Weinstein[4] has employed emetine for the control of hemorrhage following nasopharyngeal operations. He injected $\frac{1}{2}$ grain before or after the operation. No satisfactory explanation is given for his results. Nicola[5] reports 21 cases of *hemoptysis* in tuberculous patients *treated by the subcutaneous injection of emetine.* In analyzing his cases, he states that a good result with emetine can be counted on only when the hemoptysis occurs in the early stages of tuberculosis and there is not much loss of blood or in cases with high blood-pressure. If, on the other hand, the hemorrhage arises

[1] United States Naval Medical Bulletin, July, 1915.
[2] Journal of American Medical Association, May 8, 1915.
[3] Loc. cit.
[4] Medical Record, January 10, 1915.
[5] Gazetta d. ospedali e delle cliniche, December 17, 1914.

as the result of passive venous congestion, or an ulcerative process with low blood-pressure, the emetine not only failed to arrest the hemorrhage but induced mild toxic symptoms if the drug was pushed.

I have repeatedly pointed out in PROGRESSIVE MEDICINE the extreme uncertainty of controlling pulmonary hemoptysis by means of drugs. Nicola's results, in my judgment, are worthless. In the first place, the hemoptysis that occurs in early tuberculosis is always slight and in any case needs no treatment other than rest. High blood-pressure is practically never associated with tuberculosis except in the early stages and therefore hemoptysis in these cases will be in need of no active medication.

As was to be expected, no results were obtained in the advanced ulcerative cases.

Glycerin. One of the most annoying conditions to deal with is *bromidrosis*, or offensive sweating. The condition is usually limited to the soles of the feet and occurs most frequently during the hot months of the year. The affection is highly resistant to treatment. Benians[1] reports 2 cases of a very severe type in which the condition had persisted for some months in spite of energetic treatment and every effort to ensure cleanliness. In both cases there were blisters and abrasions. A complete cure was obtained in the course of three days by the application of glycerin well spread over the soles and toes before the socks were put on, this being repeated each morning.

Ruediger,[2] as a result of some investigations he has made, concludes that glycerin has a distinct, although feeble, germicidal action. This varies greatly with the temperature and also with the diluent employed. When diluted with physiological salt solution, the microörganisms died much sooner than in glycerin diluted with bouillon or with horse serum. According to Ruediger, glycerin seems to be a selective poison for the bacillus of plague, the spirillum of cholera and the bacillus of diphtheria. It is possible that, in the case of the latter, it might be available in the treatment of diphtheria carriers.

Gold Chloride. In India, where a large number of people annually succumb from the effects of snake-bites, especially that of the cobra, the discovery of an efficient antidote is of the greatest importance. Acton and Knowles[3] state that the efficiency of any remedy used for this purpose is limited by two factors, namely, the necessity of inoculating the patient before a fatal dose of the venom has been absorbed, and, second, the fact that only such venom as it happens to come into contact with *in situ* will be destroyed.

As the result of experiments, Acton and Knowles believe that the immediate injection of from 10 to 20 c.c. of a 1 to 5 per cent. solution of

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[1] Lancet, December 5, 1914.
[2] Philippine Journal of Science, November, 1914.
[3] Indian Journal of Medical Research, July, 1914.

gold chloride is the most efficient local remedy and that in some cases this measure alone may save life. In other instances it will reduce to a minimum the amount of venom which has to be dealt with by means of systemic remedies. In case of bites on the fingers or toes, where large amounts of fluid cannot be injected, they advise one of two procedures. Either a complete dissection of the area of the bite should be made and crystals of potassium, or, preferably, of zinc permanganate should be rubbed in or an injection of $\frac{1}{2}$ to 1 c.c. of a concentrated solution of gold chloride should be made at several points in the neighborhood of the punctures. They incline to the belief that the injection of a gold chloride solution is the preferable method.

Several years ago the use of fine crystals of *potassium permanganate* was advocated as being an almost certain cure for cobra poisoning. Later, it was shown that the permanganate had little or no effect. Bannerman, who was among those who first discredited the use of permanganate, has published some experimental results. He[1] concludes that a dog bitten by a cobra cannot be saved by the local application of powdered potassium permanganate rubbed into the wound after free incision of the bitten place; nor by a similar application of a solution of the powder. The dog may be saved, however, by the immediate subcutaneous injection of 10 c.c. of a 5 per cent. solution of permanganate, but this is so strong that it produces gangrene of all the tissues of the foot. And, if this treatment is delayed for even two minutes, a fatal result cannot be averted. Bannermann also states that a dog bitten under natural conditions by a Russell's viper cannot be saved by the local application of potassium permanganate.

Heliotherapy. While not original with him, Rollier, of Switzerland was the first to systematically utilize the sun's rays in the treatment of *surgical tuberculosis.* Briefly, his theory is as follows: "It is in surgical tuberculosis that we have seen the best results from heliotherapy, and we have made the treatment of it our life-work. As a result of my experience in the use of the light-cure in higher altitudes, based on an experience of nine years, I maintain today that the cure of surgical tuberculosis in all its forms, in all stages, as well as at every age of life, can be accomplished.

"To regard surgical tuberculosis as a local disease which can be cured by local treatment alone is a ruinous error. On the contrary, it is a general affection which requires general treatment. Of all infectious diseases, it is the one in which the individual resistance plays a deciding part. Our first effort, therefore, is directed to improve general conditions and thus to bring about a healing of the local focus by treatment of the entire system. A rational local treatment is necessary as well, provided it is not too one-sided."

[1] Indian Journal of Medical Research, July, 1914.

The method of applying the exposures to the sun is considered below. Webb[1] emphasizes the necessity of not neglecting other surgical methods. Splints, braces, and the like are employed, when necessary, to limit the motion in diseased joints. The appliances are made as light and as open as possible. Open wounds, when not being sunned, are dressed with gauze soaked in alcohol. Such "open" cases are found more refractory to the treatment than "closed" cases. Webb has carried out this method of treatment for three years at Colorado Springs, and while finding it to be of much benefit to patients suffering from surgical tuberculosis, as well as those with pulmonary tuberculosis, he does not, as yet, share the same high degree of optimism for the method which is held by Rollier. Webb warns against the careless employment of sun-baths without proper medical control, as harm can be done by them. The head should be protected, especially at first, by a light hat, and, in the case of adults, Rollier sometimes advises covering the heart with a wet compress.

For those who are inclined to try heliotherapy, it must be borne in mind that sun baths are not without danger. Römer[2] has recently called attention to the subject. He points out that the habit of lying about on the sand of a bathing beach is particularly harmful. The danger may be much more than a severe sunburn. In two cases coming under his observation, headache and symptoms of meningitis developed after the youths had been lying several hours in the sunlight with unprotected heads and no clothing but bathing trunks. Spinal puncture confirmed the diagnosis of serous meningitis and relieved the headache.

Römer states that the anemic and nervously predisposed city in-door workers are especially prone to lie about the beach in the sunshine. Instead of being benefited, the nervous are made more so, and, aside from some tan, are in worse condition at the end of their vacation than before. Römer points out that even Rollier, the most expert and most successful adherent of heliotherapy, uses the utmost caution in using the sun's rays. Not only is the portion of the body to be exposed limited, but the greatest care is taken as to the length of the exposures.

It is very well known that ocean bathing is quite as likely to do harm as good, and perhaps one of the causes of its being harmful is the practice of lying about the bathing beach so scantily clad that nearly the whole body is exposed to the hot rays of the sun. What Römer says of the German seaside resorts is equally applicable to American resorts.

Pottenger,[3] in an article dealing with the application of *sunlight in the treatment of pulmonary tuberculosis*, states that there are two methods which may be followed in the employment of solar energy. The patient may be stripped and the entire body exposed to the sunlight, or the light

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[1] Journal of Outdoor Life, September, 1915.
[2] Deutsche med. Wochenschrift, July 8, 1915.
[3] Interstate Medical Journal, August, 1915.

may be reflected from large mirrors. When mirrors are employed, it is necessary to cut off the heat rays. This may be done by covering the mirror with blue glass.

The length, as well as the extent of exposure, is important. The first exposure should be of only a small portion of the body, and should be for only a few minutes. The legs, arms, chest or abdomen may be exposed first, the part first selected is apparently of relatively little importance. The initial exposure should be five minutes. This may be increased five minutes a day, and the amount of surface also be gradually increased until finally the entire body is exposed for an hour.

The treatment should not be loosely applied. The patient should have the head protected from the direct rays and any untoward symptoms carefully noted. If weakness, faintness, headache, nausea, or any other symptoms referable to the light should appear, the exposure must be cut down in time, or extent, or both.

When, on account of privacy, it is impracticable to expose the bare skin, very thin white garments may be worn.

Blondes do not endure the sun baths as well as brunettes as their skin does not contain as much pigment. For this reason they are not as well protected and are more apt to burn. In addition, blondes seem to show more nervous irritability than the brunette when exposed to the sunlight.

Pottenger has employed sunlight reflected from large mirrors (three feet in diameter) more often than the full sun bath. These mirrors are covered with blue glass to cut off the heat rays. He concentrates the light on a focus about 6 to 8 inches in diameter at a distance of about $3\frac{1}{2}$ feet from the reflection. In this way there is a concentration of rays which affords a bath rich in blue, indigo and violet and quite an increase in ultra-violet over what could be had in the general direct sun bath. If, in addition, the patient sits in the sun, a large portion of the body is exposed to the direct rays of the sun during the bath, and this proves to be a combined local bath of reflected concentrated chemical energy and a direct sun bath at the same time.

When applying this treatment in pulmonary cases, it is Pottenger's practice to concentrate the reflected rays on that portion of the chest of the patient which is the seat of the disease. He begins with an exposure of five minutes and increases this five minutes a day, until an exposure of forty minutes has been reached. Forty minutes seems to be the limit in the great majority of cases.

Pottenger does not claim any special merit for heliotherapy in the treatment of pulmonary tuberculosis. It is to be classed along with other tonic measures which build up the patient and make him more resistant to infection. It is not as applicable as open air, good food, hygienic living, hydrotherapy, optimistic surroundings and a carefully regulated life, because the particular rays which are not energetic in

their therapeutic action, the chemical rays, are only found in large quantities in certain favored places where the atmosphere is clear, and are especially interfered with in all regions where the atmosphere contains impurities, particularly smoke.

Those who attempt its application in pulmonary tuberculosis will be disappointed if they expect to see certain immediate results.

Schäffer,[1] of Denmark, states that at the sanatorium of which he has charge he has employed *sun baths in the treatment of bone and lung tuberculosis* since 1902. Since that time, 364 patients have been given systematic heliotherapy. He avoids the sun baths in patients with a tendency to hemoptysis or progressing pulmonary lesions. Schäffer states that while no direct influence on the lung process was ever apparent, now and then certain symptoms seemed to improve. As a rule, the patients enjoyed the baths and seemed to feel refreshed after them.

There seems to be no doubt that surgical tuberculosis is directly benefited by the Rollier method of heliotherapy and is now pretty generally employed throughout the world. Kisch[2] reports twenty cases of surgical tuberculosis in which he combined Bier's method of local hyperemia with the heliotherapy. He believes that this accelerates the cure, particularly in cases where there are fistulas. Some cases of severe tuberculous of the ankle, knee or elbow, with fistulas, were completely healed in from four to five or six months. He regards active or passive exercise of the joints as an indispensable element in the treatment.

It has now been some years since attention was called to the benefits of open-air treatment for ordinary surgical cases. And, while there has been no radical change in the management of this class of cases, there is no doubt that more and more attention is being given to the general hygiene, and especially to better ventilation. Dyas[3] advocates going a step further, exposing the wound itself to the air. Noting that Rollier had obtained remarkable results in the treatment of surgical tuberculosis which, in many instances, had gone to the worst stage and most of which were secondarily infected with pus organisms, Dyas was led to treat old suppurating wounds by the open-air method.

The patient is put to bed, if the affected area be on the lower extremity, as so frequently occurs in the form of foul varicose ulcers, a cradle is placed over the limb, and thrown across this is a piece of mosquito netting to prevent contamination by flies or small pieces of tissue flying in the air. In some cases a current of air from an electric fan was played on the wound for from fifteen minutes to half an hour, four or five times daily. Dyas states that the rapidity with which the discharge diminishes and the odor disappears is nothing short of marvelous.

[1] Zeitschrift f. Tuberculose, June, 1915.
[2] Archiv f. klinische Chirurgie, 1915, cvi, No. 4.
[3] Journal of American Medical Association, May 29, 1915.

Because of the fact that sunlight baths are so frequently dependent on climatic conditions, various expedients have been devised to substitute artificial light. I have already referred to the method employed by Pottenger. Du Pan[1] uses the quartz mercury lamp which sends out rays closely approximating direct sunlight. The middle ultra-violet rays act on the skin, and, although useful for lupus and other superficial lesions, they are not only useless but injurious in treating deep lesions. These rays can be filtered out by interposing a sheet of "pastel" glass, white on the cut edge. Four or five children can be exposed to the light at one time. They lie on a large table which slopes toward the centre. Each wears goggles to protect the eyes, but no clothes, the aim being to imitate as closely as possible the method followed in using the direct sunlight. Du Pan reports 32 cases in which he obtained very encouraging results. The cases treated included tuberculosis of the knee, spine, hip, osteomyelitis and chronic peritonitis.

Gardner[2] is of the opinion that the warm, moist, stagnant air, held by the clothes or coverings in contact with the body of a tuberculous patient is not agitated rapidly enough even during the open-air cure. This air, physiologically considered, is of even more importance to health than the fresh air inhaled. It will be recalled that in PROGRESSIVE MEDICINE for last year mention was made of some experimental work in this regard by which it was shown that if the body be confined in a close, foul room, and although the individual breathes fresh outside air through a tube, the same constitutional effects are produced as though the stagnant air were actually inhaled.

Owing to the difficulties which one often encounters in applying sun baths, Gardiner has devised an apparatus that, as nearly as possible, represents conditions found in nature when the open-air bath is taken. The constant current of changing air found outdoors is artificially produced by an electric fan introducing a current of air, that is first passed through screens. These break up the current of air, making it flow gently and avoiding a draught. The air at the intake is the room air at 70° F., as it is not necessary to use cold, outdoor air, moving air being sufficient. After passing the screen, the air passes into a framework covered with the bedclothes, and placed over the nude patient who remains in bed undisturbed, with the head uncovered and not within the framework. Inside this framework six incandescent lamps give their heat to the skin and, although devoid of actinic rays, heat the body very much as does the sunshine in the oper-air bath.

Gardiner claims for this method the advantage of being able to apply it to very ill patients without the necessity of changing their position in bed. Then, too, by turning off in succession one lamp after

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[1] Revue médicale de la Suisse romande, September, 1914.
[2] Transactions of the American Climatological Association, 1914.

another the temperature can be safely and efficiently reduced without producing a depressive action.

Kaolin. This is also referred to as aluminum silicate, kaolinum, fuller's earth, and bolus alba. Kaolin is used in various bacterial infections because of its great absorptive powers.

Nearly ten years ago, Stumpf[1] published his experience with kaolin in the treatment of *Asiatic cholera* and other *bacterial infections.* His attention was attracted to the possible disinfecting virtues of clay by his observation that cadavers exhumed after being buried in clay soil were always in a remarkable state of preservation in comparison with those in other soil. Stumpf's belief was that the kaolin owed its efficiency in bacterial infections to its action in depriving the bacteria of a suitable culture medium while mechanically burying them alive, separating them from the mucosa and other tissues by a protecting, comparatively impermeable coating. Acting on this conception, he applied it as a remedy to extensive wounds, putrid leg ulcers, etc. He also showed by experiments on himself that finely pulverized kaolin could be taken in large doses internally without harm. Given to cases of cholera, he found that colics and the tendency to vomit were at once arrested. The kaolin was given in a dose of 125 gm. This is poured on top of half a glass of water and after sinking to the bottom, is thoroughly stirred and the whole amount taken at once or within a few minutes. This amount is given every three hours.

During the present European war the internal use of kaolin has been practiced with success in the treatment of *cholera, dysentery*, and *typhoid fever.* Wolff-Eisner[2] expresses the view that kaolin has triumphed over cholera. He also reports 25 cases of dysentery and typhoid fever in which the diarrhea was almost immediately stopped after two teaspoonfuls each of kaolin and charcoal were taken from one to three times a day. In the severer cases, the amount of kaolin was doubled. In this connection it might be mentioned that Kraus and Barbara[3] report favorably on the use of kaolin and charcoal in the treatment of infected wounds. This method, they believe, should be of service in preventing the occurrence of *tetanus*, as both substances would absorb the toxins and prevent their entering into the tissues.

Von Willuki[4] also reports favorably on the use of kaolin in the treatment of cholera and dysentery. He also tried it in 2 cases of paratyphoid bacillus carriers, and, in both instances the organisms quickly disappeared from the stools. Wolff-Eisner had a similar experience with healthy carriers. Stumpf,[5] as a result of microscopic studies, found that the use of kaolin freed the intestines of bacteria.

[1] Journal of American Medical Association, June 12, 1915.
[2] Therapie d. Gegenwart, 1915, xvii, 92.
[3] Deutsche med. Wochenschrift, April 1, 1915.
[4] Münchener med. Wochenschrift, 1914, lxi, 2356.   [5] Ibid., 1914, lxi, No. 40.

As kaolin causes no toxic effects, it has been recommended as a gastric astringent and as a substitute for bismuth in *x*-ray work.

Owing to the absorptive power of kaolin, Hektoen and Rappaport[1] conceived that it might be of service in removing bacteria from the nose and throat, especially in *diphtheria carriers*. They found that, properly applied, kaolin in the form of a dry powder removes not only diphtheria bacilli, but also practically all bacteria from the nose in the course of from three to four days. The powdered kaolin is blown into the nose six or seven times a day at two-hour intervals by means of a rubber bulb attached to a glass tube, the free end of which tapers a little. In order to get the maximum effect, the kaolin must be thoroughly distributed over the nasal surfaces. Any obstruction in the nasal passages renders proper insufflation more difficult.

In order to secure the most thorough application of kaolin to the mucous membrane of the throat, the patients, if old enough, are instructed to swallow as slowly as possible one-third teaspoonful of kaolin four or five times during the day. In adults and older children, this involves no special difficulty, but in the case of small children it is somewhat difficult.

Hektoen and Rappaport state that in a number of cases, in some of which there were a great many diphtheria bacilli in the throat, complete and apparently permanent removal has been accomplished by means of kaolin in the way described, in from two to four days, the throat to a large extent being freed from all bacteria. They also found that the insufflation of kaolin into the nose in cases of rhinitis in scarlet fever appears to improve the condition rapidly and to remove streptococci and other bacteria quite promptly.

Aside from a feeling of grittiness when taken into the mouth, the kaolin produces no disagreeable features. The writers suggest that the use of kaolin may be advantageous in cases of acute infection as well as in those who are carriers.

Fantus[2] has contributed a study on *fuller's earth* and its antidotal value for alkaloids. He points out that the absorptive power of fuller's earth from various sources depends, to a certain extent, on the degree and uniformity of fineness of the specimen. Mere sifting raises the value, if a considerable amount of coarse particles be present; elutriation also increases its absorptive power.

Fantus calls attention to the fact that while the United States Dispensatory as well as the National Dispensatory quote fuller's earth as one of the synonyms of kaolin, it is of importance to point out that there is a marked difference in the absorptive power of these substances. Kaolin, as well as fuller's earth, is considered to be essentially composed of

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[1] Journal of American Medical Association, June 12, 1915.
[2] Ibid., May 29, 1915.

hydrous aluminum silicate; the latter being merely less pure than the former.

Lloyd[1] discovered the fact that the addition of fuller's earth to alkaloids greatly diminished or almost abolished their bitter taste and that most alkaloids could be quantitatively removed from solutions by means of it. Lloyd showed that this property of fuller's earth resided in the finest particles of the earth, which he seperated by elutriation from the coarser portion and to which the name "Lloyd's reagent" has been applied.

The ability of fuller's earth to extract alkaloids led Lloyd to hope that it might be available as an antidote in case of poisoning from these agents. This, however, proved not to be the case. Later, Lloyd suggested to Fantus that the addition of tartaric acid or of stearic acid might increase the antidotal value. This proved to be true for tartaric acid but not for stearic acid.

In experimenting with the antidotal value of fuller's earth, Fantus found that by adding tartaric acid or sodium dihydrogen phosphate he was able to modify the effect of the poison and even save life.

Strychnine Poisoning. By the addition of tartaric acid or sodium dihydrogen phosphate to the fuller's earth he was able to prevent convulsions and save life in small rabbits, even if administered five minutes after the poison had been given. The sodium dihydrogen phosphate was much superior to the tartaric acid. Two mg. per kilogram was invariably fatal to dogs. The addition of fuller's earth saved life, but did not prevent convulsions. The addition of tartaric acid or sodium dihydrogen phosphate frequently prevented convulsions and generally saved life but emesis was so frequently produced as to vitiate the results. Morphine was therefore given about an hour before the administration of the poison. This preliminary administration of morphine produced vomiting and often defecation within the hour, followed by a depression of the vomiting centre, so that the doses of fuller's earth were retained. Fantus states that the fact that it was possible to save the life of morphinized dogs, even if the antidote was given five, ten or fifteen minutes after the poison, while the antidote failed to produce such results without the morphine, requires further study.

Morphine Poisoning. The antidotal value of fuller's earth is much greater for morphine than for strychnine. This, Fantus states, is probably due to the fact that morphine is much more readily removed from solutions by fuller's earth than are any of the other alkaloids, as well as to the slight solubility of the morphine and the large dose required to produce death in these animals. Fuller's earth alone saved rabbits from as much as twice the fatal dose of morphine, if given ten

[1] Journal of American Pharmaceutical Association, May, 1914.

to fifteen minutes after the poison; it failed if given twenty minutes later. Fantus believes that the administration of fuller's earth, at intervals, in morphine poisoning in human beings is indicated, even after the hypodermic administration of the poison for evacuation of the stomach. As morphine is excreted into the stomach, it would be absorbed by the clay and its reabsorption prevented or at least delayed.

Cocaine Poisoning. Fuller's earth is an antidote to cocaine.

Nicotine Poisoning. If fuller's earth and sodium dihydrogen phosphate are given with a fatal dose of nicotine no ill effects occur, but if the antidote is given five minutes later, death ensues. The action of the nicotine is evidently too rapid to admit of any interval between the giving of the poison and the antidote.

Ipecac Poisoning. Fuller's earth is a powerful antidote to ipecac. If given mixed with the poison, no damage is done; if delayed for ten minutes, the animal is seriously affected by the poison, but recovers. If delayed twenty minutes or more, the administration of fuller's earth did not save the animal but it modified the effects of the poison and postponed death in proportion to the length of time that elapsed between the administration of the poison and of the antidote.

The value of fuller's earth in *aconitine* and *colchicine poisoning* is of doubtful value.

In order to put the question to an approximate test whether fuller's earth would be likely to act in human beings as it does in the lower animals, Fantus and one of his associates took eight doses of methylene blue with and without fuller's earth. When a dose of 0.01 gm. of methylene blue is taken, a dark green color appears in the urine within a short time and disappears within twenty-four hours. If 1 gm. of fuller's earth is added to 0.01 gm. of methylene blue in solution, the urine acquires a faint greenish tint for twenty-four hours, the difference between the two specimens being quite striking.

It is to be noted that fuller's earth alone postponed the appearance of the discoloration, lessened the duration of intense discoloration, but not the duration of slight discoloration. The addition of a small amount of sodium dihydrogen phosphate did not increase very greatly the effect of fuller's earth.

Mercury. In last year's review I quoted Wilbur to the effect that the number of instances of poisoning from bichloride of mercury tablets was unduly large. In Wilbur's opinion this could be ascribed, in large part, to the ease with which the tablets can be obtained and also to the fact that antiseptic tablets containing bichloride of mercury are being offered for sale without being properly designated as containing a dangerous poison.

In a paper read before the Association of American Physicians in May, but not yet published, Lambert called attention to the tremendous

increase in the number of cases of poisoning from bichloride of mercury. Sabbatani[1] states that the same is true of Italy, and that during the past few years the number of cases of fatal poisoning from mercuric chloride is progressively increasing.

From 1903 to 1912, there were, in Italy, 4993 cases of fatal poisoning, and of this number 38 per cent. were due to mercury. Sabbatani is of the opinion that this number is below the actual facts, as probably the death from bichloride poisoning was, in some instances, ascribed to other causes. He estimates that if we assume that only one in three or four dies, the number of cases of poisoning would total six or eight thousand in the ten years in question, in a population of 33,000,000. He states that the average of nearly a thousand cases a year has been exceeded in the past two years, and that the number of suicides by this means has increased from 20 in 1899 to 309 in 1912. In his opinion, this great increase in poisoning from bichloride is due to the fact that the drug is so easily obtained. A law should be passed prohibiting the sale of tablets containing bichloride of mercury, except on a physician's certificate; and even then, as Sabbatani suggests, the number should be limited so that the amount will be used up soon and none of the tablets are left over.

Grunbaum[2] records an extraordinary experience. He states that a few days after the arrival of 800 Russian prisoners, 200 of the men developed stomatitis and a number also had a sore throat. At first it was thought the affection was a form of Vincent's angina. When the men were taken to the hospital it was found that they were all wearing a strip of black cloth nearly two yards long and an inch wide. This was wound around their bodies on the bare skin. The cloth was impregnated with mercury, the droplets of which could be seen glistening in the cloth. The bands had been given the men two weeks previously and were intended to protect them from lice.

Lieb and Goodwin[3] have investigated the question as to whether mercury is excreted by the gastric mucous membrane. They point out the fact that it has long been known that mercury may be recovered from the stomach washings of patients who are under the systemic influence of this metal and that the presence of mercury in the gastric contents does not depend on the method by which the drug is administered. Lieb and Goodwin state that there are three explanations as to how the mercury finds its way into the stomach: (1) It may be excreted by the salivary glands and swallowed with the saliva; (2) it may be excreted in the upper part of the duodenum and regurgitated into the stomach; (3) it may be that the drug is actually excreted by the gastric mucous membrane. In the case of 1 and 2 the presence of the mercury would simply be a contamination.

[1] Gazetta degli ospedali e delle cliniche, January 14, 1915.
[2] Münchener med. Wochenschrift, May 25, 1915.
[3] Journal of American Medical Association, June 19, 1915.

No matter how the drug reaches the stomach, its presence there is of the greatest importance, for when the drug is passed on into the small intestine, it is again absorbed. This cycle of excretion and reabsorption may, they believe, explain the persistent systemic action of mercury, and probably accounts for the prolonged stay of the metal in the organism. While this is distinctly advantageous, as for instance in the treatment of syphilis, it may be a real danger in patients who have taken large doses of mercuric chloride, either accidentally or with suicidal intent.

The experimental work of Lieb and Goodwin was undertaken at the suggestion of Lambert in order to determine whether the mercury actually was excreted by the stomach. If such is the case, it has an important bearing on the treatment of poisoning from the drug. Their experiments indicated that the mercury probably is excreted by the stomach itself and that gastric lavage, advocated by Lambert, is an essential part of the treatment.

Another article on the treatment of poisoning from mercuric chloride has been contributed by Barbour.[1] He conducted some experiments to determine the value of Hall's[2] new antidote. The latter, in order to render the mercury insoluble in the body, proposed the employment of an alkaloid dissolved in a potassium iodide solution. The alkaloid selected was quinine, as being comparatively harmless and readily obtainable. Hall's formula is as follows:

Potassium iodide	7.35
Quinine hydrochloride	4.0
Water	480.0

This forms a precipitate with mercuric chloride in dilute acids or alkaline carbonates, and should therefore compare favorably with the ordinary antidotes now given into the alimentary canal. In some serum tests, Barbour found that the chief obstacle in applying this method was that the mercury has a far greater affinity for tissues (for instance, the proteins and other colloids in the blood serum) than for any non-toxic remedy that can be found. The antidote proved unavailing in mice and rabbits that had been given mercury subcutaneously.

Barbour points out that when mercury is taken by mouth, as is usual in cases of poisoning in man, it is impossible to tell how much reaches the circulation. It is believed that 1 decigram of corrosive sublimate, if rapidly absorbed, is the minimum lethal dose for an adult. It is well known, however, that enormous doses are sometimes taken and yet no symptoms follow, although treatment is delayed for hours. In such cases the poison has been taken after a hearty meal, which prevents

[1] Journal of American Medical Association, February 27, 1915.
[2] Wayne County Medical Society Weekly, December 21, 1914.

absorption. In those cases in which recovery ensues, the drug has been gotten rid of by vomiting, purging or some other hindrance to rapid absorption by the body, such as a full stomach or gastric atony.

Although Hall's antidote fails to render the mercury already in the tissues insoluble, and therefore innocuous, Barbour believes that it may be employed to advantage by mouth under the same circumstances that tannic acid, white of eggs, or milk are given. These measures he considers simply as adjuvants to gastric lavage which should be the real objective in treating corrosive sublimate poisoning.

It is well understood that mercury has a very irritating effect on the kidneys, and in poisonous cases the degenerative changes in these organs are very marked.

Two interesting cases of acute mercurial nephritis are reported by H. C. Wood, Jr.,[1] and Foster.[2] In Wood's case, the patient took five bichloride tablets (presumably $7\frac{1}{2}$ grains each) by mistake. Symptoms did not develop for over an hour. The usual treatment was followed out. The most interesting feature of this case was the almost complete suppression of urine for a period of about a week. In spite of this there was an entire absence of any symptoms suggestive of uremia, either headache, high blood-pressure, urinous odor to the breath or disturbed intellection. Efforts to stimulate the action of the kidneys or to induce sweating failed. The patient died on the twelfth day. Wood refers to a case reported by Dabsenz[3] in which only ten drops of urine were passed in five days, the patient eventually recovering.

In marked contrast to Wood's case is the one reported by Foster.[4] In this case anuria was at no time a symptom. When the quantity of urine fell below the normal amount, it was adequately accounted for by the low ingestion of fluids, and, when the water intake was forced, there was apparently a normal response in the output. Of the symptoms which are usually associated with uremia there were also observed in this case, besides the evidences of renal disease, epileptiform convulsions, muscular twitching, and a psychosis of the usual toxic type. Death occurred on the forty-first day, and at the necropsy the renal lesions found were those usually encountered in cases of corrosive sublimate poisoning.

Wright and White[5] have treated 28 cases of *pyorrhea alveolaris* with hypodermic injections of the *succinimide of mercury*. Nine of these cases had associated systemic infections. They state all of the cases were completely cured.

Their method is as follows: Careful expression of the pus from the pockets; thorough removal of calcareous deposits and tartar, wherever

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[1] Wayne County Medical Society Weekly, February 6, 1915.
[2] Archives of Internal Medicine, May, 1915.
[3] New York Medical Journal, July 26, 1913.   [4] Loc. cit.
[5] Medical Record, March 13, 1915.

found; the extraction of hopelessly diseased teeth and roots; and polishing of the tooth structure. These procedures are followed by painting the gums with equal parts of tincture of iodine, tincture of aconite and chloroform every other day. This so-called specific treatment consists in the injection of the succinimide of mercury every seventh day. The initial dose for a male is $\frac{3}{5}$ grain which may be slightly reduced at each succeeding dose. For females the dose is $\frac{1}{5}$ to $\frac{2}{5}$ grain less.

The longest period of time required to effect a cure was forty-one days, and the shortest, four days. The largest number of injections required was six, and the smallest number, one.

I have already referred to the use of emetine in the treatment of pyorrhea alveolaris. In view of the fact that the ameba is so contantly associated with this condition and the specific action exerted by emetine on this protozoan is generally acknowledged, the treatment of pyorrhea by emetine seems more rational. Furthermore, the drug is less dangerous than mercury.

For the past two years, Datt[1] has employed the *red iodide of mercury in the treatment of enlarged malarial spleen.* In his hands the drug has reduced the size of the spleen and greatly improved the general health of the patients. The result is accomplished by the production of a leukocytosis. He employs the following combination, which is administered by mouth:

Red iodide of mercury	gr. $\frac{1}{20}$
Potassium iodide	gr. ij
Water	f℥ iij

After two weeks he increases the mercury to $\frac{1}{16}$ grain per dose.

Datt suggests that the drug might be of service in the treatment of kala-azar.

A painless method of intramuscular injections of salicylate of mercury is described by Candler.[2] He employs a 10 per cent. solution of mercury salicylate in liquid petrolatum and 1 grain of novocain to the ounce. Of this solution, he usually injects 1 c.c., which contains approximately $1\frac{1}{2}$ grains of mercury salicylate and $\frac{1}{32}$ grain of novocain. He uses a ground-glass syringe with a slip-on needle, gage 26 and length 4 cm. The needle is inserted alone, and, if a vein has not been entered, the syringe is attached and the mercury injected. The application of a hot, moist towel following the injection favors the early absorption of the mass and, together with the novocain, practically eliminates all pain and tenderness.

Opium. The increasing number of those addicted to habit-forming drugs has been a matter of serious concern for some years. At the

[1] Indian Medical Gazette, September, 1914.
[2] Michigan State Medical Society Journal, April, 1915.

instigation of the United States a commission made up of representatives of thirteen nations met in China in 1909, and at the Hague in 1911. A year later an agreement was signed outlining a program for the national and international control of certain narcotic drugs.

The United States Congress has passed three bills designed to check this evil. The first bill prohibited the importation of opium for any other than medicinal purposes. The second forbade the manufacture of smoking opium in the United States. These bills attracted relatively little attention, as few were engaged in the importation of opium and none were known to manufacture it for smoking purposes.

The third, and most important, bill was that known as the Harrison Law, enacted December 13, 1914, to become effective March 1, 1915. This bill was designed "To provide for the registration of, with collectors of internal revenue, and to impose a special tax upon, all presons who produce, import, manufacture, compound, deal in, dispense, sell, distribute, or give away opium or coca leaves, their salts, derivatives or preparations, and for other purposes."

It was apparent with the enactment of this law that following the date of its enforcement many habitués would be deprived of their supply and would seek relief in public institutions. As predicted, this happened, although not to the extent looked for. Drysdale[1] gives an account of the experience noted in the City Hospital of Cleveland.

The following table shows the number of admissions to the hospital from January 1 to April 1, 1915:

	Males.	Females.	Total.
Under treatment, January 1, 1915 . .	3	1	4
Admitted, January 1 to March 1, 1915 .	17	3	20
Remaining, March 1, 1915	8	2	10
Admitted, March 1 to April 1, 1915 .	29	13	42
Total admitted January 1 to April 1, 1915	46	16	62

It will be seen that there was a very marked increase in the number of admissions for the first month in which the law became operative.

The following table shows the disposition of the cases:

	Males.	Females.	Total.
Discharged recovered	31	11	42
Escaped	8	..	8
Remaining, April 1, 1915	7	5	12
Total	46	16	62

It will be noted that 42 of the 62 cases were discharged as recovered. This is questionable. The opium or cocaine habit is not cured in so short a time. While it may occasionally occur, it is safe to state that

[1] Cleveland Medical Journal, June, 1915.

the great majority would relapse if it were possible to obtain the drug. Drysdale states that by the term "recovered" is meant that the individual was off the drug or drugs when discharged from the hospital, and does not by any means infer permanent relief of the habit. In a great many the taking of narcotics is symptomatic of a deep-seated neurosis or psychoneurosis. To contemplate permanently curing such individuals by treatment covering one month or so in a hospital is as inconsistent as it is ridiculous. The chance of a final recovery, however, is better now with the Harrison Law in effect, as the opportunity to obtain opiates will unquestionably be more difficult as time goes on.

Morphine and heroine were the drugs most frequently employed and the common methods of administration were by hypodermic and snuffing. The latter method is the one commonly used by habitués of heroine. Smoking opium is relatively infrequent among Caucasians.

A very interesting table given by Drysdale is that relating to the origin of the habit:

Indulgence (curiosity)	41
Following surgical operations	5
Following bodily injuries	3
Ill health (medication)	13

By far the largest group is that in which the habit has been acquired as the result of curiosity. Drysdale states that most of this class frankly admitted having been initiated in the use of narcotics by companions or associates. Opiates administered to persons who had undergone surgical operations and to those who had met with painful physical injuries started eight individuals on a career of drug slavery. Thirteen became addicted following medication administered to relieve some very painful condition, such as tabes, gall-stones, headache, etc. In the entire series three patients only admitted having received their "dope," so-called, from reputable physicians. The great majority of them either purchased their supply from professional venders, who made stated rounds in the town district, or at certain drug stores.

Since the law has been in force the Treasury Department has rendered several decisions designed to emphasize certain features. One passed June 10, 1915,[1] has reference to the limitation on the professional prescription and distribution of narcotics by persons whether registered or not. The decision states that registration is limited to certain named persons, and that persons not legitimately engaged in the exercise of their trade or profession cannot legally register under the terms of the act, and has special reference to the prescription and distribution of narcotics on mail order.

According to this decision, a party must be a legitimate producer, importer, manufacturer, seller or distributor of the mentioned drugs;

[1] Editorial, Journal of American Medical Association, June 19, 1915.

likewise, a physician, dentist or veterinary surgeon can register under the act and dispense these drugs "in the course of his professional practice only." Such physician, dentist, or veterinary surgeon can prescribe these drugs "When he has been employed to prescribe for the particular patient receiving such drugs" and on whom "he shall personally attend in his professional practice only," and then only "when employed to prescribe for the particular person receiving such drugs."

The editorial from which the above is taken goes on to say that the decision has special application to those persons not registered as physicians who prescribe or distribute narcotic drugs or preparations on mail orders received from so-called patients or who, under the laws of the State or municipal regulations, are not permitted to practice medicine. The extent of the so-called mail-order prescription cannot be estimated, but this recent treasury decision will undoubtedly have a tremendous effect on lessening this growing evil.

When *heroine* was first introduced it was considered to be free from the habit-forming danger. Within the past few years, however, it has suddenly come into prominence as an addiction. Among those addicted to this derivative of opium the common method of taking it is snuffing it up the nose. Crothers[1] states that when used by inhalation through the nose in the form of a powder, the effects are marked and so pleasing that the drug has become a very facinating one. The effects of heroine differ somewhat from those of morphine and the after-effects, such as depression, are not marked. It causes an exhilaration and quite soothing effect and then a period of restlessness. This is followed by a desire to again take the drug. Crothers states that heroine is a dangerous drug to a neurotic individual, and, if given to such a one, should be concealed and withdrawn at the first opportunity or replaced by *sumbul* or the milder narcotics.

In carrying out the treatment of the heroine habit, Crothers states that the rule should be to withdraw the drug at once. There is no danger in the sudden withdrawal of either heroine or cocaine. In carrying out the treatment, he administers 10 to 15 grains of sulphate of magnesium three or four times a day, unless the bowels become very irritable. For sedative purposes, Crothers advises the use of humulus, and, if this does not act promptly, he uses valerian, particularly at night. Hydropathic measures in the form of baths every day are very useful. Care should be taken not to give any form of opium or spirits.

In Crothers' opinion, heroine addiction is not a difficult thing to cure if the patient will follow directions implicity. Although I have seen but a limited number of cases of heroine addiction, it has been my experience that the habit is not difficult to cure.

[1] Medical Council, September, 1914.

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In a study of the action of the opium alkaloids, individually and in combination with each other, on the coronary artery and the coronary circulation, Macht[1] gives the following conclusions:

1. Of the principal opium alkaloids, some affect the coronary circulation markedly, others slightly, and still others not at all.

2. Morphine produces a mild dilatation of the coronary, codeine a very slight one, narcotine and papaverine, a very marked one, and narceine and thebaïne none at all.

3. A combination of morphine and narcotine produces a much less relaxation of the coronary artery than that produced by each of them individually.

4. This action of the opium alkaloids has been studied in three different ways and probably holds good in the clinic.

5. It is hoped that these observations may conduce to a more rational therapy of cardiac conditions.

Liquid Paraffin. The characteristics of paraffin oil were considered in detail in PROGRESSIVE MEDICINE for last year. In addition to its employment in cases of *constipation*, it is being more and more used in other gastro-intestinal disorders.

Jamieson[2] has raised the question as to whether the habitual use of liquid paraffin as a purgative may not cause cancer. In answer to this, Ross[3] points out that liquid paraffin is one of the later products of the distillation of crude petroleum, whereas only the intermediate oil fractions seem to be responsible for paraffin cancer. The same rule holds in the case of coal derivatives, such as tar, pitch, and soot, which also give rise to cancer, but it is only the lighter and middle oil fractions (especially the anthracene fraction) of the carbonization of coal that have this effect on the skin.

It is now pretty evident that the auxetics in tar, pitch and soot are the predisposing cause of pitch cancer. This has been shown by direct experiment and also by the fact that one can by the biological test for auxetics pick out those commodities which are known to predispose a tissue to cancer from a large number of those that do not. Auxetics have been made to cause benign cell proliferation, which itself is a predisposition to cancer, both in men and animals. They are set free in the tissues by cell death following a chronic injury, as well as being contained or produced by all the cancer-causing commodities, such as tobacco, arsenic, etc.

Liquid paraffin contains no auxetic, as proved by tests. It is produced at about 360° C., whereas auxetics become volatile at 300° to 330° C. Paraffin oil has been used extensively internally for more than a decade by the general public, including persons of the cancer age, and there has been no increase in the incidence of intestinal cancer such as one would

[1] Journal of American Medical Association, May 1, 1915.
[2] British Medical Journal, March 6, 1915.   [3] Ibid., March 20, 1915.

expect if paraffin were as dangerous as tar, soot, or the middle petroleum fractions. For this reason, Ross believes that liquid paraffin should be given a clean bill of health.

McNeil[1] has found an emulsion of liquid paraffin or castor oil, in small non-purgative doses, of great value in the treatment of various forms of *chronic dyspepsia* in children. He has employed these agents in the following conditions: Malnutrition, often associated with chronic diarrhea and only seldom with constipation; enemesis, associated with dyspeptic symptoms; recurrent vomiting (cyclical or bilious vomiting); recurrent attacks of fainting or sudden pallor; and urticaria or eczema, with dyspeptic symptoms. In the majority of cases suffering from one of these conditions there is an abnormal condition of the stools. The abnormality may consist of a true diarrhea but very often the stools are merely of a too soft consistency, with or without the presence of mucus. Constipation was present in only a small majority of the cases. A large number of the cases followed one of the common infectious diseases of childhood, especially measles and whooping-cough.

In a series of 13 cases of enemesis, 8 were cured and 3 greatly benefited by the treatment.

McNeil states that the action of paraffin oil and castor oil in these cases is similar. It is entirely local and confined to the mucous membrane of the alimentary tract. It is most probably a sedative one, exerted on the congested and unhealthy mucous membrane of the small and large intestines.

For some years I have employed an emulsion of castor oil combined with opium in the treatment of the *diarrhea* which occurs so frequently *in tuberculous subjects*. In these cases it is quite likely that the castor oil acts as a sedative. The formula is as follows:

R—Tincture opii deodorati 3ij
Emul. ol. ricini 3vj
M. Sig.—A tablespoonful two or three times daily.

On much the same principle, Barbour[2] advises the treatment of *acute bacillary ileocolitis* in children who are having a stool every hour or so. The stool is not fecal, but simply a lump of mucus more or less blood stained. Whenever true feces appear in the stool, it is an indication of improvement. He has found the following prescription helpful:

R—Olei ricini 3j–ij
Pulveris acaciæ . . . . gr. iij
Syrupi rhei aromatici 3j
Misturæ cretæ . . . . ad. 3ij
M. Sig.—One teaspoonful every two hours until the stools are fecal; when it is given less frequently.

[1] Edinburgh Medical Journal, February, 1915.
[2] Tennessee State Medical Association Journal, March, 1915.

Pritchard[1] states that while the value of paraffin oil is generally conceded in cases of intestinal stasis occurring in adults, its usefulness in the various forms of *indigestion* occurring *in infancy* is not as yet fully appreciated. It is his belief that most of the so-called troubles of indigestion in infancy are associated with disturbances of the motor functions, such as spasms of sphincters, enterospasms of dysperistalses of one kind or another. In such conditions it is extremely useful to have at hand an efficient lubricant, such as liquid petrolatum, which will penetrate to the lower bowel without absorption and without chemical change. In severe cases of so-called colic, or windy spasm in infants, Pritchard sometimes practically fills the intestines with petroleum emulsion, either alone or in combination with carbonate of bismuth.

Pritchard states that he first learned of the great value of a large dose of carbonate of bismuth when he was investigating the cause of motor disturbances in infants, by means of the bismuth feed and x-rays. Since that time he has had most gratifying results in the management of these cases by combining the bismuth with petroleum emulsion.

The chief objection to the administration of bismuth in large doses is that its grittiness makes it distasteful to infants. He has overcome this by using the preparation known as *glycerinum bismuthi carbonatis*. One or two drams of this, combined with an equal quantity of petroleum emulsion, makes a most efficient carminative for infants troubled with wind or colic. It may be given alone or combined with the contents of the infant's bottle.

Hill[2] has also used liquid paraffin in the treatment of *gastro-intestinal disorders in infants*. His conclusions are as follows:

1. In the chronic constipation of infants, liquid paraffin in large doses gives the best results the writer has yet obtained.

2. In severe gastro-enteritis and ileocolitis its use was disappointing, possibly because too small doses were given.

3. In conjunction with *lactic acid bacilli* very remarkable results may be obtained in that group of diseases caused by the action of putrefactive or allied poisons absorbed from the intestines and finding a favorable susceptible, sympathetic nervous system.

While Pritchard does not claim for paraffin oil an antiseptic action in the intestinal tract, he states that there can be no doubt that it does in some degree limit and retard the decomposition of those nutrient media in which it is combined in large proportion. The interpretation is not clear; it may be to the rapidity of transit of food through the intestinal tract, or it may be due to the inhibitory influence of the petroleum on the growth of the bacteria themselves.

Pritchard states that although paraffin oil is, in the great majority of cases, a most efficient lubricant and aperient, nevertheless, in certain

[1] Clinical Journal, July 15, 1914.
[2] Archives of Pediatrics, February, 1915.

exceptional instances it undoubtedly predisposes to constipation. This paradoxical action he explains as follows: In some individuals a regular action of the bowels can be maintained only by the stimulating and provocative action of irritating particles, such as seeds or husks of fruit and vegetables. In such cases petroleum may predispose to constipation by its emollient influence on the mucous membrane, thus depriving the rectum or its neuromuscular mechanisms of the required stimulation. Such constipation can persist after stasis in the upper reaches of the intestines has been cured by the petroleum, and thus it may do good in spite of the constipation.

Pritchard has found petroleum of the greatest value in the treatment of *threadworms* in children. In his opinion, liquid petroleum has an almost specific action as a vermifuge in such cases not so much because of a lethal influence on the parasites or their eggs but by its direct action upon the mucous membrane. Whether, however, the petroleum owes its undoubted efficacy in cases of intestinal disorder to its therapeutic effect on the mucous membrane or to its undoubted influence on the motor functions of the bowel, there can be no question that in cases of threadworm infection it acts by ironing out and cleaing up the crypts or, rather, lurking places in an unhealthy mucous membrane, in which the eggs have an opportunity to incubate undisturbed.

In PROGRESSIVE MEDICINE for last year, I alluded to some personal experiences with liquid paraffin in the treatment of that form of *indigestion characterized by distention and pain after eating* This is commonly associated with a sluggish bowel action. My experience during the past year has strengthened my faith in the remedy.

A few months after the outbreak of the European war the stock of Russian oil became exhausted. So far as I can see, the oil now prepared in this country is equally efficient.

Potassium Permanganate. Rogers[1] has found strong solutions (about 1 to 500) of potassium permanganate of great value in the treatment of sloughing wounds, such as bedsores and cancrum oris. He believes that the most important action of the permanganate is its power to oxidizing and rendering harmless the toxins produced by the bacteria. This produces a negative chemotaxis and thus prevents the phagocytic polynuclear leukocytes from dealing with the invading organisms. When the toxins are destroyed by the potassium permanganate, they no longer repel the phagocytes which are thereby enabled to attack the infecting germs. Rogers believes the use of strong permanganate solutions, not less than 1 to 500, would be of great value in washing out all wounds contaminated by dust or earth.

As the result of an experience in the tropics, Bryant[2] asserts that the addition of a few crystals of potassium permanganate to one's bath has

[1] British Medical Journal, December 19, 1914.
[2] Boston Medical and Surgical Journal, May 27, 1915.

a most extraordinary cooling effect. It also is a valuable means of promoting sleep. He states that it is only necessary to make a saturated solution of permanganate and pour enough of this solution into a wash bowl to give the water a pale pink or reddish tint, rub down with this solution and follow with a shower or bathe as desired. A solution strong enough to be effective can be used without coloring the receptacle, or, if necessary, any stain is easily removed by the use of a little oxalic acid solution. He believes that the external application of permanganate is an extremely valuable procedure in hot, humid weather. Its use in conjunction with the customary bath greatly promotes comfort by day and sleep by night at a time when both comfort and sleep are at a premium.

Bryant's discovery of this effect of permanganate was accidental. While on a visit to Java during the summer he found that one of the provisions against cholera was the addition of sufficient permanganate to faintly color the bath water.

Phenol. In a study of the effect of lavage in phenol poisoning, Macht[1] states that its efficiency depends on the quantity of poison taken, on the time after poisoning that the lavage is begun, and on the solution employed for washing out the stomach. In his opinion a strong solution of sodium sulphate is the most useful and next to this comes plain water. The influence of alcohol in phenol poisoning depends on the time of its administration. Experimentally, it can be shown that an animal that is previously intoxicated with alcohol can withstand the effects of phenol better than one to which alcohol has not been given. On the other hand, alcohol given to an animal after poisoning with phenol will aggravate the symptoms and hasten death. Macht advises strongly against the use of alcohol in cases of phenol poisoning.

Pituitrin. The remarkable effect produced by pituitrin on the pregnant uterus is now no longer a subject for debate. Its usefulness has become completely established throughout the world, and, as I stated last year, no one has failed as yet to obtain the results claimed for it. During the past year the number of articles testifying to its efficiency in obstetric practice is even larger than the year previous. Aside from confirming previously expressed views, nothing new has developed regarding its use during labor. Probably the most important thing is that, aside from a few minor criticisms, no one has found that the drug is a failure or that it produces any serious untoward results. The following aphorisms of Norris[2] point out briefly and clearly its exact status in obstetric practice:

1. Never use pituitrin without exhausting your abilities in obstetric diagnosis.

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[1] Bulletin of Johns Hopkins Hospital, April, 1915.
[2] American Journal of Obstetrics, May, 1915.

2. Healthy multiparæ, with relaxed birth canals, offer the widest and safest fields for its use.

3. For inertia in the early stage of labor, the sleep of morphine, chloral, or scopolamine is preferred; in the advanced stages of labor pituitrin will often wisely keep your forceps innocuous.

4. Ether hilarity and quick pituitrin labor in multiparæ is a good practical substitute for "twilight sleep."

5. The uterus, after pituitrin's tumultuous visitation, usually needs the steadying hand of ergot.

6. Half-doses are more often to be employed than full doses.

In regard to dosage, Norris states that the efficiency of the various preparations seems to be increasing with proper standardization. Pituitrin in 1 c.c. ampoules has with very few exceptions been efficient. It should not be used after the date specified on the container.

The tumultuous action sometimes observed from a full dose, whether due to the patient's susceptibility or to the failure in standardizing the particular dose, has made the use of a full initial dose in primiparæ infrequent in Norris' hands. The first dose usually shows a more marked effect upon the uterus than it does upon blood-pressure, unless there is an interval of three or more hours between doses. In Norris' opinion, if pituitrin were dispensed in doses equivalent to half the present size, its usefulness would not be diminished and its dangers would be lessened.

Malinowsky[1] states that some of the unpleasant effects which may be produced in the mother are: nausea, palpitation of the heart, oppression about the heart, and pallor. He believes that great care should be taken in giving the drug in the presence of any cardiac or kidney lesions.

Druskin[2] has made a comparison of the various preparations of the gland which are now on the market. He found that *pituitrin* is an active, good, and reliable preparation. *Pituitary extract* is more concentrated and a stronger preparation. *Pituglandol* and *pituitary liquid* seem to be weaker than either of the above. Taking it all in all, pituitrin seems to be the preparation of choice.

Several years ago Ott and Scott[3] noted in a goat that the *secretion of milk* was rapidly and greatly increased after the intravenous injection of an extract of the posterior part of the hypophysis. In their experiments, the flow started in about one minute and reached its height in four minutes, after which it rapidly fell to normal. While the extracts of other glands of internal secretion, such as the corpus luteum, pineal body and thymus, may increase the milk flow fourfold in five minutes, pituitary extract is the most powerful galactagogue, increasing the milk flow a hundredfold or more. The observations of Ott and Scott

[1] Monatschr. f. Geburtsh. u. Gynäk., 1914, xl.

[2] American Journal of Obstetrics and Diseases of Women and Children, October, 1914.

[3] Proceedings of Society of Experimental Biology and Medicine, 1910, viii, 48.

were confirmed by Schafer and Mackenzie[1] on other species of lactating animals. They also found that the extract of the anterior lobe of the pituitary body was inactive.

The hope that the use of pituitary extract might be of service for increasing the milk output of cows has proved futile. Jill and Simpson[2] found, from some experiments on cows, that the intravenous injection of pituitary extract, either the whole gland or the posterior lobe alone, leads to an immediate secretion of milk very rich in fat. The effect, however, quickly passes off. There is a corresponding diminution in the yield of milk at the next milking period, and to some extent in the percentage of fat, so that in the twenty-four hours there is practically no increase in the total quantity of milk or of fat obtained.

In another article, Hill and Simpson[3] give their experience with pituitrin in nursing women. They summarize their observations as follows: (1) In a young, healthy, married woman, nursing her second baby, in the fifth month of lactation, the injection of 1 c.c. of pituitrin, was followed, in ten minutes by a marked increase in the amount of milk secreted; (2) after a latent period of from twenty to thirty seconds, the mother could feel the milk "coming into the breasts," and in a few minutes later, abdominal pains were experienced, presumably due to increased intestinal peristalsis; (3) the milk withdrawn after injection was rich in fat, the average figure for the three experiments being 5.5 per cent. as compared with 3.4 per cent. for three days when no pituitrin was administered. In the milk yielded twenty-four hours after injection, the fat content was still somewhat above the normal; (4) although no quantitative estimations were made, judging from the mother's experience in nursing the child, it would appear that the quantity of milk obtainable by it on the morning after the injection was diminished.

R. C. Hughes[4] states that about two years ago he was led to try the effects of pituitary extract in women whose milk was deficient. Since then he has routinely employed the drug with great success. Having now employed the pituitary extract in a number of cases, Hughes feels justified in drawing the following conclusions:

1. The drug has proved very valuable and is to be depended upon.

2. No unpleasant clinical phenomena have been noted, although the drug has been taken, in some cases, for as long a period as two weeks or more.

3. The drug has had not only a temporary, but a permanent, effect.

4. The failures generally occurred in cases of the ignorant, who would not follow instructions.

[1] Proceedings of Royal Society, 1911, lxxxiv, 16.
[2] Proceedings of Society of Experimental Biology and Medicine, 1914, xi, 82.
[3] American Journal of Physiology, October, 1914.
[4] Therapeutic Gazette, May, 1915.

5. No observations were made other than its effect as a galactagogue.

6. Those of his colleagues who have found the drug inefficient have given it hypodermically and then only in one or two doses.

Hughes makes no mention in his article either of the amount given or his method of administration. I take it, however, that he gives the drug by mouth, as the last conclusion intimates that failure has followed one or two hypodermic doses. Furthermore, some of the patients were seen at infrequent intervals so that the drug must have been taken by mouth.

Last year several articles were quoted testifying to the efficiency of pituitrin in cases of *intestinal stasis*. Miller[1] states that pituitrin has no superior in cases of intestinal paralysis following operations. Heretofore we have used enemas and purgatives. In many cases these are ineffective, the purgatives are often vomited and the gut fills up with gases which greatly increase the patient's discomfort. Following an injection of pituitrin, a bowel movement may be expected within fifteen minutes. In Miller's experience, its action is positive, and one can confidently expect results.

Howell,[2] in commenting on its ability to produce and maintain a rise in blood-pressure, states that the selective action on involuntary muscles as a whole should not be overlooked. He calls especial attention to its stimulating action on the intestinal musculature with reference to tympanites. Bandler,[3] Zueblin[4] and King[5] also speak highly of pituitrin in cases of intestinal stasis.

Last year I called attention to the danger to which patients suffering from pneumonia are sometimes exposed, namely, marked abdominal distention due to tympanites. In the light of the present testimony regarding the efficiency of pituitrin in cases of *intestinal paralysis*, it would seem that it would be an ideal drug in cases of pneumonia in which abdominal distention becomes a menace. The fact that the drug is also capable of producing, or at least of maintaining, a rise in the *blood-pressure* would be an additional reason for the employment in this disease. It is now pretty well recognized that in most cases of pneumonia the gravity of the case is in direct relation with the excess of the pulse-rate over the blood-pressure. The lower the systolic pressure as compared with the frequency of the pulse, the more likely is the case to have a fatal termination. On the other hand, those cases in which the rise of frequency and the fall of pressure are both moderate, run a much more favorable course. It becomes apparent, therefore, that any agent which will decrease the pulse-rate and correspondingly increase

[1] Pan-American Surgical and Medical Journal, August, 1914.
[2] American Journal of Medical Sciences, October, 1914.
[3] Medical Record, January 9, 1915.
[4] Boston Medical and Surgical Journal, December 24, 1914.
[5] Ibid., January 30, 1915.

the blood-pressure, will aid in tiding the patient over the danger-point. Cohen[1] believes that pituitrin is the best agent for this purpose. The drug is administered in doses of 1 c.c. every three hours, more or less, according to the effect produced.

That pituitrin has a very definite influence on the circulatory apparatus is becoming more and more apparent and observations which were first made upon animals are being confirmed from the clinical standpoint. Zueblin[2] has reported 7 cases of *cardiovascular disease* in which he employed putuitrin. Although admitting that the number of cases is small, the fact that all 7 of his cases were serious and that only 2 terminated fatally, leads him to believe that the use of pituitrin as a cardiac stimulant deserves a thorough trial. He cautions against the free use of the drug in cases of arteriosclerosis, believing that it may produce a sudden harmful rise in the blood-pressure. Hare,[3] in commenting on this observation, thinks this danger is more apparent than real since simultaneously with the rise in blood-pressure there must be also a stimulation of the heart muscle. If the heart muscle has undergone such an extreme degree of degeneration that pituitrin is unable to stimulate it, it is highly probable, almost certain, that an equal degree of degeneration has taken place in the muscular fibers of the bloodvessels, and therefore no extra strain will be thrown upon the heart.

The dose employed by Zueblin consisted of one ampoule of pituitrin (1 c.c.) injected subcutaneously to meet marked evidences of circulatory failure. The pituitrin was followed by a 10-minum dose of the tincture of digitalis three times daily. In some instances, a dose of pituitrin was given on several consecutive days. He found that its employment did not always raise the blood-pressure but seemed, in some instances, to slightly lower it. In other instances, however, where the blood-pressure was already abnormally low, pituitrin was effective in raising it.

Howell[4] states that pituitrin produces and maintains a rise in blood-pressure better than does adrenalin, and therefore is more reliable in conditions of circulatory collapse than is adrenalin. Hewlett[5] says that pituitrin is the only drug which will convert the abnormal pulse form, so frequently seen in fever, into a relatively normal pulse form. Whether it will prove of value in febrile collapse can only be determined by actual trial at the bedside.

Results directly opposed to those just quoted are reported by Beco and Plumier.[6] These observers, in a clinical study of the action of

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[1] Medical Review of Reviews, March, 1915.

[2] Medical and Surgical Journal, December 24, 1914.

[3] Therapeutic Gazette, April, 1915.

[4] American Journal of Medical Sciences, October, 1914.

[5] Michigan State Medical Society Journal, April, 1915.

[6] Abstract, Edinburgh Medical Journal, September, 1914.

pituitrin in cardiac cases, concluded that the action upon the frequency and rhythm of the pulse, upon the respiration, arterial tension and diuresis is abdolutely *nil*. They administered the drug subcutaneously, intramuscularly, and intravenously. Given subcutaneously and intramuscularly, even very large doses are well borne.

Intravenous injections caused troublesome secondary phenomena eleven times out of nineteen. A few minutes after the injection the patient complains of vertigo, headache, sensation of flushing of the face, humming in the ears, a tendency to syncope, oppression and a feeling of constriction in the thorax, weight in the lumbar region, abdominal colic, with a constant imperative desire for defecation, which proves ineffective. The patient is anxious, his face pale and covered with sweat, the extremities are cold and cyanosed, the pupils are dilated and the axillary and rectal temperature does not vary. Sometimes the patient complains of a bitter metallic taste in the mouth.

So far as we are able to judge, the weight of evidence in favor of pituitrin exerting a marked influence on the cardiovascular apparatus must be decided in the affirmative. Experimental work points conclusively to this fact, and the majority of clinical observations tend to support this view.

The influence of pituitrin on respiration has been studied by Nice, Rock, and Courtright.[1] Their conclusions are as follows:

1. The characteristic effect of pituitary extract on respiration is an increase in the depth, followed by a shallowness and a decrease in the rate.

2. In some cases, however, the increase in depth of respiration is followed by shallowness and an increase in the rate.

3. The effect of pituitrin on the respiratory mechanism occurs synchronously with that on the circulatory system. The effect, however, on respiration passes off sooner than that on circulation.

4. After a few injections of pituitrin, the respiratory mechanism becomes immune and the characteristic responses are not elicited.

Gordon[2] has employed *pituitrin* as a coagulant in *surgical operations on the nose and throat*. He administers the pituitrin hypodermically in the dose of 12 minims to children and 15 minims to adults, not less than fifteen minutes before the anesthetic. His conclusions are:

1. The coagulation time of the blood is materially reduced by the hypodermic administration of pituitary extract.

2. The hemorrhage following nasal and throat operations is much reduced, especially operations on the turbinals.

3. The effect on the blood-pressure of children is variable. Systolic pressure was increased in 55.31 per cent. of the cases, reduced in 36 per cent. and unchanged in 8.5 per cent. Diastolic pressure was in-

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[1] American Journal of Physiology, September, 1914.

[2] Journal of American Medical Association, January 23, 1915.

creased in 35.5 per cent., reduced in 35.5 per cent. and unchanged in 29 per cent. The pulse-pressure was increased in 61 per cent. and decreased in 39 per cent. of the cases.

Minet and Martin[1] employed pituitrin in 20 cases of *hemoptysis* due to tuberculosis in all stages, cancer, and infarct of the lung. The drug acted successfully in 19 of the 20 cases. They attribute the therapeutic action to diminution of the tension in the lesser circulation, stimulation of the muscular coats of the pulmonary vessels, and a very energetic coagulant action.

Bandler[2] and Miller[3] state that pituitrin is the most effective agent we possess for the control of *postpartum hemorrhage.*

As the result of an experimental study on the *effect of pituitary extract on the secretion of cerebrospinal fluid,* Weed and Cushing[4] are inclined to believe that the increased flow obtained by them represents an actual secretory response rather than an expulsion of preformed fluid due to physical conditions resulting in changes in the volume of the brain. He also believes that the increased rate of production of cerebrospinal fluid, following the injection of extracts of the hypophysis, is caused by stimulating the secretory activity of the choroid plexuses.

Quinine. In commenting on the results of the antimalarial campaign in Italy, Bertarelli[5] states that in ten years there has been a reduction from more than 15,000 to 3000 deaths. The regularity with which this decline has occurred is in itself proof of the efficiency of the measures adopted. Bertarelli states that the decline again recorded for the year 1912–1913 coincides with an increase in the consumption of quinine provided by the State, while there was also, during the same period, an increase in the amount of quinine sold privately in the country. He feels that there must be some connection between these facts, and that it is difficult to explain in any other way the reappearance of a decreasing mortality.

Bertarelli does not support the view of some observers to the effect that the malarial parasite exists not only in malaria-infected man but also in some other animal, so that the infection of the transmitting mosquito arises not only from the gametiferous man, but also from these other animals which harbor the organisms. In his opinion, man is the only source of the disease.

In regard to the prophylactic use of quinine, the author is strongly of the opinion that the free consumption of this drug in malarious districts is the weapon which has given the most certain and rapid results.

[1] L'echo méd. du Nord, 1914, p. 193.

[2] Medical Record, January 9, 1915.

[3] Pan-American Surgical and Medical Journal, August, 1914.

[4] American Journal of Physiology, January, 1915.

[5] Il Morgagni, Lancet, March 27, 1915.

Until within the past few years the belief that the prophylactic use of quinine was an efficient means of preventing malaria was pretty generally entertained. Recently, however, considerable skepticism has arisen regarding the ability of quinine to prevent malaria when taken over long periods of time. Observations made in India and in the Panama Canal Zone seem to show that the use of small prophylactic doses of quinine, while they may keep the disease in check for a time, are ultimately disadvantageous because the parasite of malaria, continually subjected to doses which are not large enough to kill it, gradually becomes immune to quinine. When quinine is stopped, malarial paroxysms therefore develop and it is difficult to destroy the microorganisms in which an artificial immunity, to the otherwise specific drug, has been engendered.

The disadvantages of small doses as enumerated by McGuire[1] are: (1) that the symptoms are atypical and therefore difficult of diagnosis; (2) that the parasites in the peripheral circulation often could not be found at all, or only with great difficulty; (3) that the giving of the quinine was considerable trouble and at times caused discomfort; (4) that, in addition to 60 cases in which the parasite was found in the blood, there were 9 patients who had a high, irregular fever which responded to adequate doses of quinine and which was undoubtedly malaria. As a result of his observations upon several marine regiments serving in Culebra, McGuire concludes that quinine in doses of from 5 to 8 grains daily will not prevent malaria, although it may retard or delay the symptoms; that persons infected with malaria while taking quinine in prophylactic doses may not show any evidence of the disease while the drug is being used, but after it is discontinued will come down with acute malarial paroxysms; and, finally, he aligns himself with those clinicians, who are rapidly increasing in number, who adhere to the belief that the taking of quinine for a long time in moderate doses induces a tolerance on the part of the malarial parasite.

Sodium Citrate. Spitzig[2] calls attention to the frequency with which women suffer from *congestive dysmenorrhea*. The causative factors are faulty hygiene, defective elimination, nitrogenous overindulgence, sedentary occupation, and tight lacing. At the time of uterine congestion, the blood in the organ is more viscid, and with the accompanying stasis there is greater infiltration of serum into the neighboring tissues. This induces a change in the chemical equilibrium of the endothelial cells by causing the cellular colloids to absorb more serum and transforming this gelatinous material into a viscid mass. The effects are greater distention of the spongy layer and increased vascular stasis and mucus production, with the consequent shedding of fibrinous and thrombotic membranes.

[1] United States Naval Medical Bulletin, October, 1914.
[2] Journal of American Medical Association, February 27, 1915.

Spitzig proposes to diminish the viscosity of the blood and hence avoid the condition described above. As nitrogenous food raises the viscosity of the blood, it is restricted before the menses. Catharsis will deplete the portal circulation, and at times a hot compress may be applied for the purpose of bringing about relaxation. The important feature of the treatment, in Spitzig's opinion, is the reduction of the viscosity of the blood through the use of sodium citrate, 20 grains three times daily, during the week or two preceding the expected period.

The clinical evidence in support of the efficacy of this treatment is the improvement of pain and the reduction of clots and membrane in the menstrual discharge. Furthermore, nausea, dizziness, headache and mental irritability are greatly lessened.

Spitzig protests against self-medication in menstrual pain, and warns against the use of any mixture containing alcohol. The use of the latter is dangerous, as it may lead to chronic alcoholism.

Strychnine. The great majority of physicians if asked what stimulant they would administer in cases of sudden cardiac failure, would unhesitatingly answer, strychnine. Furthermore, it is widely believed that strychnine given hypodermically is the most efficient agent we have in cases of sudden emergency.

Newburgh[1] has studied 8 cases of ruptured compensation with special reference to the influence of strychnine. His conclusions are that neither pharmacological nor clinical evidence justifies the use of strychnine in the treatment of acute or chronic heart failure. The type of case cited by Newburgh is the sort that more often than not terminates fatally no matter what is done. To condemn strychnine or any other drug for failure to bring about marked improvement in cases of severe ruptured compensation, is not a fair test. For instance, an individual suffering from auricular fibrillation, myocardial degeneration, dilatation of the heart, general edema, hydrothorax and ascites, is not the type that offers very brilliant results, no matter what the medication may be.

As a matter of fact, strychnine has very little place in the treatment of ruptured compensation. When used as a cardiac stimulant, strychnine is almost always employed to meet the emergency caused by sudden cardiac failure. This much is certain, it is firmly believed by a large number, nay the majority, of clinicians, that strychnine when given under these circumstances does do good. Hare,[2] in commenting on Newburgh's condemnation of strychnine as the result of failure in eight cases of ruptured compensation, takes the stand that we cannot lightly brush aside the observations of competent clinicians. "A man might just as well conclude that there was adequate evidence that there is no God after having conversed with eight atheists as to conclude that

[1] American Journal of Medical Sciences, May, 1915.
[2] Therapeutic Gazette, August, 1915.

strychnine is of no value after having used it in 8 hopeless cases, particularly when millions of people believe that there is a beneficent God, and thousands of physicians believe that strychnine aids them in saving life in the face of undoubted sudden cardiac failure."

Theobromin. In the treatment of *angina pectoris* Kohn[1] states that theobromin can be relied on as confidently as digitalis in cases of broken compensation. In the presence of an actual attack of angina, morphine is used to relieve the pain and relax the spasm of the coronary arteries, but, to ward off attacks, no drug is superior to theobromin. Kohn states that it is marvelous to witness how theobromin arrests the tendency to repeated mild or abortive attacks. Patients long tormented day after day or night after night, are freed at once from their symptoms. He deplores the lack of general appreciation of the efficiency of theobromin in the treatment of the fundamental disturbances which are the bases for angina pectoris. In addition to the use of theobromin, the patient should be kept in bed until the cardiac disturbance has subsided; exercise should be forbidden or taken very sparingly; and the use of tobacco stopped.

Brooks[2] has contributed a very interesting article on the effect of *tobacco* on the heart. He points out that the prolonged excessive use of tobacco often induces arrhythmia and intermission. In addition, there is a more or less persistent sense of weight or of pain of a dull, obstinate character in the heart region. Pain may be entirely independent of alterations in rhythm, though most likely to occur with a slowing of the usual rate. These symptoms are more likely to appear in chronic smokers than in beginners, and in long-standing, rather than recent, tobacco habituation.

In regard to the anginoid symptoms which sometimes occur as a manifestation of tobacco heart, Brooks states that they are identical with the symptoms occurring in true angina pectoris. This form of tobacco heart is encountered among chronic habitués. As to the causation of the trouble, Brooks states that, so far as can be determined, the condition is due to coronary claudication. There is no clinical or experimental evidence that disease of the heart muscle is caused by tobacco. The fact that all symptoms disappear when tobacco is discontinued seems to confirm this statement.

Tobacco angina is promptly relieved by discontinuation of tobacco; no such result can be obtained in true angina pectoris. While death may result from tobacco angina, it is probably very rare and most likely occurs only when anatomically diseased coronary vessels preëxist. For this reason it is probably unwise to permit the use of tobacco in circulatory diseases when symptoms of cardiac embarrassment occur.

Vaccines. TYPHOID FEVER. As pointed out in PROGRESSIVE MEDICINE for last year, the phenomenal success which has attended the

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[1] Berliner klin. Wochenschrift, May 17, 1915.
[2] New York Medical Journal, April 24, 1915.

use of prophylactic vaccines in the prevention of typhoid fever has led a number of observers to employ the vaccines in the treatment of the disease. Krumbhaar and Richardson[1] have reported 92 cases of typhoid fever treated with vaccines in the Pennsylvania Hospital. In addition, they have collected from the literature over 1700 cases treated by other observers, making a total of 1806 cases so treated. Their conclusions are as follows:

1. The curative use of typhoid vaccines in the course of typhoid fever, in order to stimulate further antibody formation, has a logical theoretical basis, although its mode of action has not as yet been demonstrated experimentally. Practical proof of its value is afforded by the rise in agglutinin curves after such vaccination.

2. The proper use of vaccines in the treatment of typhoid fever has been found, in over 1800 cases, to be without harm, and usually to be followed by beneficial results. The 93 cases reported by us support this view.

3. The best results are obtained if the injections are begun early in the disease, especially before the tenth day. Late in the course of the disease, except in selected cases, the value of vaccine (both theoretically and practically) is more dubious. In the chronic complications of typhoid, such as periostitis and cholecystitis, good results have been obtained from vaccines by other investigators.

4. The contra-indications against vaccine treatment of typhoid are not yet clear. We should hesitate to advocate their use in moribund or very toxic cases, during hemorrhages or suspected perforations, or in such complications as pneumonia or otitis where other organisms are involved.

5. The best dosage has also not been determined. Semple, Petrowitch and Watters, and Eaton have had good results with small doses; McArthur, Fletcher and Meakins, and Foster equally good results with much larger doses. While this would indicate to some that the true benefit lay elsewhere, we feel that the discordance is due to differences of patients and epidemics, preparation of vaccines, and "personal factors." The dosage must vary within certain limits for each patient and no cut-and-dried rule should be attempted. The more severe the infection, the smaller and more cautious must be the dosage. With our methods of preparation, we felt that the best initial dose for the average adult was 500 million; if this proved to be the proper amount, two or more larger doses were given usually at three-day intervals.

Garbat[2] recommends, both for prophylaxis and treatment of typhoid fever, a sensitized vaccine. He defines sensitization as the mixing of an antigen (bacteria, red-blood cells, proteins, etc.) with its specific antibodies. These antibodies are found in the serum of an animal that

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[1] Pennsylvania Medical Journal, January, 1915.
[2] Journal of American Medical Association, February 6, 1915.

has been previously immunized with the particular antigen. If, for example, a rabbit or goat receives injections of typhoid bacteria; the usual antibodies (agglutinins, bacteriolysins, bacteriotropins [opsonins], complement-fixation bodies, etc.) appear in its serum. If an emulsion of typhoid bacilli be now mixed with this serum, inactivated, the bacteria becomes sensitized; that is, during the process of sensitization the bacteria unite with the specific immune bodies present in the serum. Sensitized bacilli may be dead or living, depending on whether the bacteria have or have not been killed previous to being mixed with the immune serum.

Garbat, who has treated 17 cases with sensitized vaccine, believes that this method offers a more rational therapy from an immunological point of view than by ordinary non-sensitized vaccine. He states that the repeated inoculation of large doses of sensitized vaccine, even in very sick patients, was not attended by any harmful effects or a distinct negative phase. The general course of the disease seemed milder, and the complications less frequent. In a small percentage of the cases the disease terminated by crisis. From this small experience, he is inclined to believe that even more striking results may be attained by a larger number of smaller doses more often repeated.

For prophylactic immunization against typhoid fever, Gay and Claypole[1] recommend three injections of the sediment of a dried, ground, sensitized culture of several local strains of the typhoid bacillus mixed together, given at two-day intervals and in a dosage of $\frac{3}{32}$ mg. of the original dried culture, which corresponds, as has been determined, to a dosage of approximately 750 million living typhoid bacilli. Gay and Claypole state that their experimental and clinical results, as well as the work of many other investigators, led them to believe that the agglutinating power of the serum is by no means indicative of the degree of protection afforded against infection with the typhoid bacillus. They believe that the skin test with typhoidin solution is of far more prognostic value. They state that persons immunized with various types of typhoid vaccines react in the majority of cases for about two years and then become more frequently negative. The authors regard a negative skin test after vaccination as an indication for revaccination.

Favorable results from the use of vaccines in the treatment of typhoid fever are also reported by Pensuti,[2] 69 cases, and by Golscheider and Aust,[3] 57 cases. In addition, Ichikawa[4] reports on the abortive treatment of typhoid and paratyphoid by means of intravenous injections of the vaccine. He claims that both typhoid and paratyphoid can be abortively cured by intravenous injections of vaccine made by sensitiz-

[1] Archives of Internal Medicine, 1914, xiv, 67.

[2] Policlinico, February 20, 1915.

[3] Deutsche med. Wochenschrift, March 25, 1915.

[4] Sei-J-Kwai Medical Journal, December, 1914; abstract, Journal of American Medical Association, February 6, 1915.

ing the living typhoid bacillus with the serum of typhoid fever patients in the convalescent stage.

An interesting report of an epidemic occurring among hospital employees, nurses and doctors, is contributed by Elmer[1]. In all, about 250 persons were exposed to the disease which was traced to the kitchen and dining-room. Of this number, 42 developed the disease. Twenty-three cases developed among those who had received no vaccine. The average duration of the disease in these patients was a little under six weeks. None of the cases was very severe, and none died. The remaining 20 received one or more doses of vaccine prior to the manifestation of the disease. There was apparently little difference in the severity of the disease in those who received vaccine and in those who did not. The appearance of symptoms directly following injections of the vaccine in some of the cases may be explained, according to Elmer, in at least two ways: These patients were either well along in the stage of incubation when the injections were given, and therefore the vaccination was only an incident which caused them to be watched more closely, or the vaccine, acting as many other foreign substances do, temporarily lowered their resistance and thus precipitated the onset of the disease. Elmer believes that if this latter view be accepted, it is possible to conceive of a few who, had it not been for this temporary lowering of resistance, might have overcome the infection.

The lesson to be derived from this experience is that the use of anti-typhoid vaccine in persons who are harboring typhoid bacilli does not increase the number of those who develop the disease. A single injection or more, directly preceding or during the incubation period of the disease, does not render the individual immune, nor does the course of the disease seem to be modified by injections of vaccine directly preceding the disease. Elmer questions whether it is advisable to administer the vaccine to those presumably infected, as it may, in a few instances, precipitate an attack.

A very interesting report of the character of the typhoid infection in individuals who have been previously immunized has been contributed by Trowbridge, Finkle, and Barnard.[2] Having found that there were 8 "carriers" among 1601 inmates in the institution with which they were connected, a total of 1520 of the patients were given prophylactic injections of typhoid vaccine.

Three months subsequent to the completion of the administration of the vaccine, 57 cases of typhoid fever developed. Of this number, 46 were inmates and the remainder were employees. Only 1 of the employees had received the prophylactic, and 3 of the inmates were uninoculated.

The epidemic was traced to the dairy; the investigation showing

[1] Journal of American Medical Association, April 3, 1915.
[2] Ibid., February 27, 1915.

that the dairyman had an ambulatory case of typhoid. His wife was also ill at the time with what proved later to be typhoid. In addition, a milker was also a victim of the disease. Milk formed part of the diet of every individual who contracted the disease.

As a result of their experience, Trowbridge, Finkle and Barnard conclude that typhoid fever may be contracted by individuals who have received the prophylactic and who subsequently show a positive Widal reaction. Although the course of the disease is not appreciably shortened in vaccinated individuals, the mortality-rate is markedly reduced in such persons. Protected individuals who develop the disease fail to give many of the classical symptoms of typhoid. They also conclude that the degree of immunity conferred by the prophylactic in some cases fails to prevent the development of typhoid when the individual has been subject to repeated exposures.

The value of prophylactic injections has become so thoroughly established that it is now universally accepted. The history of every war during the past one hundred years shows that the loss through illness has far surpassed that which obtains as the result of wounds. If reports up to date are to be believed, the great contrast between wars of the past and the present titanic conflict is the reversal of the proportion between those slaughtered by weapons and those perishing as the result of preventable diseases. The one disease above all others, which, in the past, has claimed the greatest number of victims in time of war, is typhoid fever. We have only to recall the Spanish-American and the Boer wars to realize the truth of this statement.

Crile,[1] as the result of personal observation, states that the principle advances in military surgery, as noted in the data furnished by the present war, are the absence of typhoid fever and tetanus among the soldiers, due to the routine practice of administering prophylactic treatment.

Because of the splendid results obtained in the French army, Maurange[2] has urged the people of Paris not to wait for an epidemic of typhoid fever but to protect themselves by means of prophylactic vaccinations. As a result of the campaign inaugurated by him, 5100 persons had taken advantage of this advice. The vaccination office is open four times a week for two hours and the service is rendered gratuitously.

Boyd[3] has reported the effects of prophylactic inoculations as observed in 18,000 soldiers. He concludes that in the great majority of cases inoculation is a harmless procedure, involving, at the most, a certain degree of temporary discomfort, and those constitutional symptoms comprised under the term "inoculation fever." In a few cases the sequelæ are of a more serious nature.

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[1] Cleveland Medical Journal, May, 1915.
[2] Presse Médicale, December 22, 1914.
[3] Canadian Medical Association Journal, May, 1915.

Before administering the vaccine, Maurange[1] inquires as to whether the applicant has had typhoid, scarlet fever, pleurisy at any time, recurring bronchitis or bowel trouble, and whether there is albuminuria present. In case of doubt, the urine is examined and the lungs ausculted, and all suspects are advised to abstain from the inoculation. It will be recalled that last year the question was raised as to whether tuberculous individuals should receive the vaccine. Russel stated that he had never seen an ill-effect under these circumstances. It was furthermore pointed out that if tuberculosis should be known to be present the initial dose, as a matter of precaution, should be much smaller than usual. And if no ill-effects occurred, subsequent inoculation could be continued.

Following the administration of typhoid vaccine Wade and McDaniel[2] state that the blood of persons immunized according to the directions of the U. S. Army should show the presence of the Widal reaction at a dilution of 1 to 50 in the large majority of cases, probably about 90 per cent. Failure to find this high percentage of positive Widal reactions, this vaccination appears to indicate some technical error in methods and an accompanying failure to confer full immunity. They suggest that, in communities in which paratyphoid occasionally appears, especially in institutions, it might be preferable to use a mixed vaccine of typhoid and paratyphoid, as recommended by Castellani. They state that, in institutions, vaccination alone must be considered the only necessary prophylactic measure to be taken against the occurrence of typhoid.

PERTUSSIS. The New York Department of Health has appealed to the physicians of New York for their collaboration in the more extensive use of vaccine in the treatment of pertussis. The Health Department took this step because of the favorable results already reported.

Luttinger[3] states that the stock vaccine prepared by the Health Department Laboratories seem to have a prophylactic value when given in high doses. Furthermore, the use of the vaccine seems to shorten the duration and severity of the paroxysmal stage. The duration of the whoop, in cases treated with the vaccine, averaged twenty-five days; compared to forty days in those treated with drugs. Luttinger urges closer coöperation between the physician and the public health authorities in order that the vaccine treatment of pertussis may be made more effective. The need of more study is also emphasized by Hartshorn and Moeller.[4] They point out that the vaccine treatment has not yet been universally indorsed, and that a great variety of vaccines are being used without definite knowledge of the bacteriology

[1] Loc. cit.   [2] American Journal of Public Health, February, 1915.
[3] New York Medical Journal, May, 1915.
[4] Archives of Pediatrics, August, 1914.

of the individual case. While the size of the dose is still undetermined, they believe that, as a rule, it is too small.

Hartshorn and Moeller, in reporting 18 cases treated with vaccines, state that the initial dose should be at least 50,000,000 in older children, and this may be doubled at subsequent treatments up to 400,000,000 at five-day intervals. In their experience, a certain number will not respond favorably to a vaccine, and in these it should not be continued after a trial of four doses. In case the stock vaccine fails to produce results, they recommend trying an autogenous vaccine.

There seems to be no doubt but that the results so far obtained warrant a much more extended use of the vaccine treatment. This can be best accomplished, as Luttinger suggests, by a closer coöperation on the part of physicians and the health departments of various municipalities.

GONORRHEA. In the treatment of gonorrheal arthritis, Gramenitsky[1] states that Bier's hyperemia treatment is very effective, although it will not cure all cases. Hyperemia treatment is best suited to the acute and subacute cases. He believes, however, that the very best results are obtained by immunization therapy. In addition, vaccine treatment has a very distinct advantage because of its cheapness. Gramenitsky obtained his best results by combining the hyperemia and vaccine treatments; this method is particularly valuable in very old, chronic cases. He states that the influence of vaccine in gonorrheal urethritis is very slight.

In a report on the gonococcus complement-fixation test, Thomas and Ivy[2] state that inoculations of gonococcus bacterin, antigonococcic serum, etc., may in themselves, by the production of immune bodies, be causes of positive reactions. How long these immunizing effects endure is unknown, but they have observed patients, treated by immunotherapy, who one year later demonstrated negative complement-fixation reactions.

McArthur,[3] in writing on the use of autogenous vaccines in the treatment of leucorrhea, states that in acute gonorrhea the results were dramatic in some instances. The symptoms would rapidly abate, and in six or eight weeks it would be impossible to find material in the cervix, vagina or Bartholin's glands to make a culture of gonococcic. Some cases required more prolonged treatment, but in all cases the results were extremely encouraging.

LEUCORRHEA. This is one of the most troublesome conditions encountered, and only too often, in spite of all that is done, the discharge is little, if at all, diminished. McArthur[4] has contributed a very inter-

[1] Beiträge z. klinischen Chirurgie, September 2–3, 1914, Bd. 89.
[2] Archives of Internal Medicine, January, 1914.
[3] Australian Medical Journal, May 16, 1914.
[4] Ibid.

esting article on the use of autogenous vaccines in the treatment of leucorrhea. He has noted that when the discharge, no matter how excessive in quality, is of white-of-egg color, it is habitual to find that it consists of mucus and fragments of exfoliated epithelium and no leukocytes. When a culture is made, the germs are non-pathogenic. When the leucorrhea assumes a yellow color, the Staphylococcus albus will be found to be present constantly. When the discharge is yellow and thick and produces marked engorgement of the vaginal and labial mucous membrane, it is usual to find the presence of the gonococcus or the colon bacillus. The streptococcus can be found fairly often, and, when present, is generally of very low virulence. He has been much struck with the frequency with which the colon bacillus has been present. In some instances it has existed in an almost pure culture. In view of the great frequency with which leucorrhea is present in tuberculous women, it is interesting to note that McArthur has never found the tubercle bacillus in the discharge.

McArthur at first injected the vaccine into the cervix, but abandoned this method because of the severe pain it produced. He now gives the vaccine every fifth day in alternate flanks under the skin. Aside from slight local tenderness, there are no ill-effects. His best results were obtained when the infection was acute and the organisms were of a virulent type. The gonorrheal cases, which have been alluded to above, gave by far the best results. Almost equally good results were obtained when the discharge was caused by the colon bacillus. When the discharge is caused by non-pathogenic germs, the results are not so encouraging. The treatment in these cases has to be continued for from three to ten months. While he was always able to get rid of dominating germs, he very frequently had the experience of having the woman return in a few weeks with the discharge as bad as ever, and on making a culture to find that an entirely new set of organisms had been introduced.

McArthur states that it is, of course, necessary to look for the presence of any local lesion, such as a torn or eroded cervix, and if such a lesion is present it should be repaired.

Curtis,[1] in a study of leucorrhea, also found that the bacteria are usually of low pathogenicity. He states that autogenous vaccines decrease general malaise and backache, and, when aided by correction of associated pathology, their influence upon chronic purulent discharges is beneficial. A large number of patients are helped only so long as vaccines continue to be administered; a smaller number are permanently improved; and a fair percentage appear to be cured.

Curtis emphasizes the fact that in the treatment of chronic leucorrhea it is essential to improve the general health, promote free elimination and treat pelvic complications which predispose to mild local infection.

[1] Surgery, Gynecology, and Obstetrics, July, 1914.

There is no doubt that the condition of the general health plays a tremendous part in the causation of leucorrhea. In a chronic disease such as tuberculosis, leucorrhea is relatively common. It may be one of the first manifestations of failing health, and, as the patient tends to grow worse or recover, the leucorrheal discharge increases or gradually disappears.

Veratrone. In PROGRESSIVE MEDICINE for last year I called attention to the fact that veratum viride or one of its active principles was being revived in the treatment of *eclampsia*. The method was introduced many years ago and has been used largely by careful practitioners. Haultain[1] has employed veratrone in the treatment of 17 eclamptic and markedly pre-eclamptic cases, with the inhibition of convulsions in every instance. One of his cases ended fatally, the woman having been the subject of chronic Bright's disease with edema for over a year. In addition to the immediate injection of 1 c.c. of veratrone, sweating is promoted by means of hot packs, and, if possible, purgation with calomel and jalep is attempted. The blood-pressure is carefully taken at frequent intervals, and if it rises over 160, $\frac{1}{2}$ c.c. of veratrone is given at once. The patient is kept on a milk diet. Without exception, after the injection of 1 c.c. of veratrone the blood-pressure was lowered markedly and rapidly, and almost in every instance with an immediate cessation of the fits. The depressant action is usually only temporary, extending over but a few hours. It is associated with a marked slowing of the pulse-rate and increase of the urinary secretion and diaphoresis. In some instances vomiting occurs, particularly when the pulse-rate falls below 55.

From both experimental and clinical observations, Haultain believes that veratrone has a further action as an antidote to the eclamptic toxin. The reason for this belief is that very often the blood-pressure temporarily rises subsequent to the injection of the veratrone and yet no fits occur. This is further supported by the comparative mildness of the action of the drug in eclamptics or pre-eclamptics, when compared with cases of simple increased blood-pressure, such as chronic Bright's disease. In the latter condition the injection of 1 c.c. of veratrone gives rise to extremely anxious symptoms of severe vomiting and syncope, associated with a marked lowering of the blood-pressure.

Veronal. The table on page 408, furnished by Eager,[2] shows the relative value of different hypnotics.

Eager points out the growing evil caused by the facilities which exist enabling the public to procure hypnotic preparations. In his opinion it should not be possible to obtain any hypnotic drug without the authority of a prescription from a duly qualified practitioner. Furthermore, when prescriptions of a hypnotic preparation are handed to a

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[1] British Medical Journal, September 26, 1914.
[2] Journal of Mental Science, July, 1914.

patient, the number of times it is to be refilled should be specified thereon by the prescriber and each time the hypnotic is dispensed the chemist ought to sign and date the prescription. Eager strongly advocates this course because hypnotics in a large number of persons tend to give rise to a craving for their continued use.

In this connection it is interesting to note that Glaser[1] has collected 9 cases of chronic veronal poisoning from the literature and adds a personal observation. The drug had been prescribed for a temporary condition and the patient had continued to use it. Even when the single doses are small, the continued use in this way is liable to entail serious symptoms. When used over a long period of time the nervous system is most affected, especially the cerebellum and the vestibular portion of the cochlea. Glaser also sounds a warning as to the necessity for care in prescribing veronal for patients with a tendency to nervous or mental asthenia, and in any event to see that the drug is not taken continuously.

Hypnotics.	Dose.	Time taken by the drug to induce hypnotic action.	Hours of sleep resulting.	Cases in which the drug is recommended.	Cases in which the drug is to be avoided.
Paraldehyde . .	2 drams	½ hour	5	Maniacal excitement	Emphysema and bronchitis.
Amylene hydrate	1 dram	1 hour	5	Maniacal excitement	
Luminal . . .	10 grains	1½ hours	10	Where other hypnotics have failed to produce sleep.	
Veronal . . .	10 grains	¾ hour	5	Early stage of maniacal excitement	Renal disease, and where a habit is likely to be set up.
Adalin . . .	15 grains	1 hour	6	Early cases of melancholia; also in sleeplessness associated with arteriosclerosis	
Chloral . . .	25 grains	¾ hour	6	Melancholia	Heart disease.
Sulphonal . .	30 grains	4 hours	7½	Chronic excitement and senile dementia.	Nephritis.

Carapoli[2] reports an instance in which a woman took 11 gm. (165 grains) of veronal with suicidal intent. Recovery took place. The patient was actively stimulated with ether, caffeine, and strychnine.

A statement to the effect that veronal is closely related chemically and therapeutically to sulphonal and trional has been taken exception to by H. C. Wood, Jr.[3] He states that while all of these drugs belong to the series of allopathic compounds and are therefore chemically related, the chemical relation between veronal and sulphonal does not seem any closer than that between veronal and chloral. For instance, the characteristic radical of sulphonal is the ethyl-sulphone group, which is not

[1] Weiner klin. Wochenschrift, October 29, 1914.
[2] Gazette degli ospedali e delle cliniche, November 19, 1914.
[3] Journal of American Medical Association, April 10, 1915.

found in veronal, while the carbamide group in veronal is not found in sulphonal.

The physiological differences between veronal and sulphonal are equally marked. While in overdose veronal is an active poison and in several instances has caused death, fatal results from sulphonal poisoning are extremely rare. Moreover, the symptomatology of the poisoning is quite different. In a large number of patients veronal, even in doses not grossly excessive, will produce dermatitis. Wood states that he has not seen any report of skin lesions following the use of the sulphones. The characteristic symptoms of chronic sulphonal poisoning is hemato-porphyrinuria, which, as far as he knows, has not been observed after the use of veronal. Even in therapeutic doses, veronal often causes a diuretic effect and this does not seem to be caused by the sulphones.

Other differences in their action might be pointed out, but Wood thinks these facts are sufficient to show that veronal is not closely related to sulphonal and trional either chemically or therapeutically.

X-rays. Pfahler's[1] method of treating *malignant disease* consists in the complete removal, or the destruction, of all visible and palpable disease by means of the d'Arsonval current, followed, or at times preceded, by full doses of the Röntgen rays, given from as many different fields of entrance as possible. In this way as much irradiation is produced as though the rays alone were depended on for the cure of the disease.

The type of case he considers as suitable for this combined form of treatment is as follows:

1. Those cases in which there is considerable area of malignant tissue, which can be removed *en masse* and which is too great to be destroyed completely by the electrical desiccation described by Clarke. For small superficial epitheliomata, warts, moles and birthmarks, Pfahler much prefers the desiccation method.

2. Epitheliomata involving the deeper portions of the lip, cheek, tongue, or alveolar process, especially those which have been treated for a considerable time with the Röntgen rays, without success. Epitheliomata on other parts of the body, which are large, and especially if they must be allowed to heal by granulations.

3. Old adherent scirrhous carcinomata of the breast in which there is no evidence of metastasis, and which are considered inoperable by surgical means.

The disadvantages of the treatment are that there is complete destruction of all the tissue between the two electrodes. Therefore there is no chance of saving the bloodvessels or nerves which are in close proximity to the disease. In addition, it leaves an open area, which is healed by granulation, but at times this healing must be followed

[1] Surgery, Gynecology and Obstetrics, December, 1914.

by a surgical plastic operation to close the mouth or to correct some deformity.

The advantages of the method are that: (1) There is complete destruction of the local malignant disease; (2) this is accomplished without opening the bloodvessels of the lymphatics, and there is therefore less likelihood of a recurrence or of metastasis taking place; (3) the wound heals with a smooth, soft scar, which resembles skin very closely; (4) at times one is enabled to apply this combined treatment in surgically inoperable cases.

Lange[1] has reported a case of *epithelioma of the lip* in which a cure was obtained by a single Röntgen-ray treatment.

In the treatment of malignant tumors, von Eiselsberg[2] has had excellent results from the use of radium and the Röntgen rays. He emphasizes the fact that the Röntgen rays should not be used as a substitute for operation. They should only be used in unoperable cases or for prophylactic treatment after operation.

Bumm[3] states that his experience has caused him to employ the Röntgen rays in the treatment of *cancer* on a larger scale than ever before. At the present time röntgenization is the main treatment he employs in carcinoma of the uterus.

With the *x*-rays alone, 5 cases of operable carcinoma coli were treated successfully. He states that in place of the carcinomatous proliferation, no pathological changes were left and during the treatment and afterward no injurious effect was noticed.

In treating carcinoma of the uterus, Landau[4] believes that the uterus and part of the parametrium immediately surrounding it should first be removed and Röntgen treatment given afterward.

Landau advocates this method for the following reasons: (1) Metastases in the fundus may not be accessible to the effects of the rays; (2) the thick wall of the uterus weakens the rays like a filter, and (3) after the removal of the uterus deeper parts of the tissues are made accessible to the effect of the rays.

Archibald[5] reports cases of carcinoma in which the *x*-rays gave excellent results. In two instances there was a cancer of the uterus; in one, a recurrence of a breast cancer, and in three the tongue was involved. In addition, the *x*-rays brought about the disappearance of a large *uterine fibroid*.

Lange[6] reports 20 cases of *menorrhagia, dysmenorrhea* and *uterine fibroids* treated by Röntgen-ray exposures. Lange states that the

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[1] Lancet Clinic, April 24, 1915.

[2] Zentralbl. f. d. ges. Chir. u. i. Grenzgeb., 1914.

[3] Berliner klin. Wochenschrift, 1914, li, 193.

[4] Zentralblatt f. Gynäkologie, 1914, xxxviii, 399.

[5] New York Medical Journal, June 5, 1915.

[6] Lancet Clinic, July 17, 1915.

results he had obtained in these 20 cases, and the satisfactory outcome of 30 additional cases in which an improved technic was employed, have led him to the conclusion that an artificial menopause can be elicited in any patient, irrespective of age, by this method of treatment.

The patients treated for menorrhagia varied in age from nineteen to forty-seven years. In all of them the condition was very chronic, and most of the patients had been curretted one or more times. All of the patients were weak and anemic, and several had become extremely prostrated.

In 7 patients the bleeding was stopped and an artificial menopause was brought about. One of the patients in whom the menopause was established was only twenty-eight years of age. He states that this case is unique in that the patient was younger than in any of the cases recorded in the literature.

Seven cases were treated for uterine fibroids. The fibroids were of the intramural or subserous types. Röntgen-ray treatment is usually unavailing and contra-indicated in pedunculated submucous tumors. In Lange's cases the size of the tumor was reduced in every case, the reduction varying from 30 to 70 per cent.

In considering the *postoperative use of the Röntgen rays*, Hofrat[1] states that they will have to be used immediately following the operation, and that it is necessary to use the rays intermittently for years at definite timed intervals. The probability of success is greater when the rays are applied through an open wound. Hofrat states that experience in "Röntgen cancer" has shown that the disposition to cancer is directly increased by the too frequent use of the rays. If the rays are used too frequently after operation, the cancerous disease is frequently aggravated and a recurrence may be directly excited.

According to Moorehead,[2] a large dose of rays applied to any gland depresses the activity of that gland, and repeated exposures lead to fibrosis. Some cases which have been operated on subsequent to a Röntgen-ray treatment have shown extensive fibrosis, more particularly of the superficial portion of the glands. The contraction of bloodvessels is recognized by Kocher, who believes that a short preliminary course of x-ray treatments may be of advantage in diminishing risks from hemorrhage at a subsequent operation.

Moorehead reports 9 cases of *Graves's disease* treated by the Röntgen rays. Of these 9 cases, 1 with very severe symptoms remained under observation for a period of three weeks only, and, with the exception of lessened tachycardia, apparently had not improved during that period. The remaining cases had been under observation for periods ranging from five years to a few months. Two had been treated too recently

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[1] Surgery, Gynecology and Obstetrics, November, 1914.
[2] Dublin Journal of Medical Science, November, 1914.

to venture an opinion, although both had been much improved. Of the remaining 6 cases, 5 were completely cured as far as symptoms are concerned. They were living an ordinary life, doing their usual work and were free from palpitation, tremor, or any of the symptoms of exophthalmic goitre. While in each one some hypertrophy of the thyroid could be detected, the enlargement was slight. On palpation, the gland was found to be firm and fibrous instead of soft and vascular. While he believes that the Röntgen rays are of service in this condition, he emphasizes the fact that no immediate striking result is to be expected, and that patience and perseverance are required.

In none of 7 cases of exophthalmic goitre reported by Fisher[1] as cured has there been any tendency toward recurrence for two years since cessation of treatment. Of 5 reported as improved, there has been an occasional tendency to attacks of hyperthyroidism, but these have been checked by renewing the exposure of the gland to the x-rays.

Two cases of *thymic asthma* successfully treated by means of the x-rays are reported by Morgan and Dachtler.[2] A radiograph taken of 1 of the cases more than three months after the treatment was discontinued, showed an absence of hypertrophy of the thymus and in addition the child had remained free from symptoms.

A number of observers have pointed out that the Röntgen rays have an intense effect on the thymus gland. Under the influence of the rays, degeneration is noted, especially of the lymphocytes, and this may be followed be regeneration.

Regaud and Cremieu[3] have experimented with the effects of the rays on the thymus in young cats. As a result of their experiments, they recommend x-ray irradiation as the method of choice in the thymus hypertrophy of children, on the hypothesis that the histological structure of the hyperplastic thymus differs in no respect from that of the normal thymus. Eight cases were cured after six to eight irradiations.

The treatment of *trichiasis*, as followed by Kempster,[4] consists of the epilation of the ingrowing cilia by means of the Röntgen rays. The technic of the operation is simple, but requires care, both in regard to the protection of the eye and surrounding parts from the rays, and also in the delivery of the proper quantity and quality of the rays, as an underdosage will produce no results and an overdosage may lead to severe inflammation of the eyelid and subsequently to scarring and contraction of the tissues.

The treatment of *ring-worm of the scalp* has been advocated by a number of observers. Mackee and Reimer[5] give a detailed report of the method employed in Fordyce's Clinic.

[1] New York Medical Journal, March 6, 1915.
[2] Surgery, Gynecology and Obstetrics, December, 1914.
[3] American Journal of Roentgenology, February, 1915.
[4] British Medical Journal, February 20, 1915.
[5] Medical Record, August 7, 1915.

Following the *x*-ray exposures, the hair begins to fall out at the end of about three weeks and starts to regrow in about three months. They state that it is essential that no irritating applications be applied to the scalp for two weeks prior to the treatment, and, if chrysarobin, tar or iodine have been used, four weeks had better be allowed to elapse.

The above-mentioned preparations are prohibited subsequent to the *x*-ray treatment.

It is preferable to allow no application for about a month, at which time a 5 per cent. ointment of sulphur or ammoniated mercury, or some other mild antiseptic agent may be employed.

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